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THE MIDWINTER CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The meeting of the American Institute of Electrical Engineers which was held last week in New York City is unique in the annals of that society. It was called for the purpose of bringing together information which would be of assistance in revising the Standardization Rules of the Institute, and was held under the auspices of the Standards Committee. Regarded from this standpoint, the convention was very successful, but it was not alone in this feature that the convention will take rank among the meetings of the Institute. In quality and amount of discussion and in number of papers presented it probably stands second to none, and in attendance it compares favorably with some of the regular annual conventions, the total registration being 421. It was significant, too, that most of the activity in the sessions was due to members from points outside of New York City. While the local membership naturally swelled the attendance figures, little contribution to the real business of the convention could be credited to them. Naturally the subjects under discussion appealed most largely to the manufacturers of electrical machinery, and especially to their designing and testing engineers, who had indeed done most of the experimental work represented in the papers contributed. Some of the large users of apparatus were represented, as were the consulting engineers, but the representation from these classes of the Institute's membership was not as large as might have been anticipated. The attitude of the manufacturers toward the convention and the revision of the Rules was commendable, there being evidenced a spirit of generous co-operation in the gathering of facts, test data and general information bearing upon the question of standardization, regardless of commercial advantage or other selfish motives. The guarding of trade secrets, so often prominent in gatherings of manufacturers in any industry, did not make itself felt; the kind of information needed in standardizing methods of test is such that any except the most narrow-minded could see that it was for the general good of the industry to have a full representation of the most up-to-date information. The fund of knowledge which was brought to the surface by the papers and discussion will stand as a permanent monument to the memory of the Standards Committee in the *Transactions* of the Institute.

Probably the most important question involved in the revision of the Standardization Rules is that of ratings. The consensus of opinion, not only in the sub-committees reporting, but also shown in the discussion, seemed to be in favor of a single rating, in place of the present method of multiple rating, to cover not only continuous loads, but also overloads. There was a fear among some that this might involve raising the rating of a given machine above its rating on the present basis, but such a recommendation from the Standards Committee does not seem likely. However, overloads, at least in the case of generators, will probably not be recognized, and it will be left to the user to determine his maximum load, and choose a machine rated to correspond. It is at best unsatisfactory to attempt to standardize overloads, since the requirements must necessarily vary with circumstances. The proposed limit of temperature rise to 50 degrees centigrade, when the safe limit of operation is recognized as 90 degrees, provides a small factor of safety for the unwary.

In the case of generators it appeared to be the general opinion that the rating should be based upon ultimate capacity, which is limited only by the ability of the insulating materials to withstand elevated temperatures. If connected to a prime mover of equal rating based on ultimate capacity, the generator is then protected from the danger of overload, since the unit would become stalled if an attempt were made to overload it.

In the case of motors, transformers and other receiving apparatus, this protection does not exist, and much doubt was expressed as to the advisability of rating such apparatus at its ultimate capacity, even with the slight temperature margin noted above. Such apparatus is self-destructive in the sense that it will carry any load that may be placed upon it, even though its temperature rises above the danger point. This is not true of all motors, of course, as a synchronous motor may fall out of step and stall if overloaded. There are other reasons, too, why some apparatus should not be rated at its ultimate capacity. The efficiency of many types of motors is a maximum at some point below their ultimate capacity, and in operation it is desirable to load at the point of maximum efficiency rather than with the highest load which the motor will safely carry. Moreover, excessive starting torques are often required. There is thus good reason for rating motors in a manner similar to reciprocating engines rather than after the fashion of steam turbogenerators.

Whatever the basis of rating, it should not be a matter of judgment, but one of definite ruling, determined by the performance of apparatus under load. With a uniform system on such a basis the user is at once able to properly choose the apparatus for the conditions of service whether these represent standard conditions of temperature, power-factor, wave-form, etc., or not; and to compare the prices of competitive manufacturers without the necessity of transforming a number of different ratings to a common basis. With a rating which is uniform, and upon a definite basis fixed by limits of temperature, of efficiency, or other characteristics of a machine, if a name-plate be lost it would be possible to redetermine the rating by a test run.

TEMPERATURE MEASUREMENTS.

One of the important developments of the convention was the recognition of the existence of hot spots in the interior of electrical machinery and the impossibility of determining the temperature at such points. Such temperature can be estimated, however, and when their existence and location have been determined for a given design of machine, a proper allowance may be made for the difference in temperature between such spots and the points actually measured. The exploring coil and the thermocouple afford a means of determining temperatures at points which cannot be reached by the mercurial thermometer. The determination of temperature by means of the resistance of one of the windings of the apparatus is necessarily limited to the average temperature of that winding and thus does not even give the maximum temperature in the copper, and may be much farther removed from the temperature of iron and insulation. Since the maximum temperature cannot be determined by the usual methods, it is not feasible to limit this in specifications, but after the general distribution of temperature in a machine has been determined for its type, a satisfactory allowance may be made and specifications limited to a statement of the temperature under the usual commercial conditions or measurement.

THE MEASUREMENT OF HIGH VOLTAGE.

One of the subjects which has been left in excellent shape by the papers at the convention is that of the measurement of high voltage. The present Standardization Rules specify the use of needle points as electrodes for a discharge through the air, the length of the gap being taken as the measurement of the voltage. With the high voltages now in common use, the use of the needle-point gap has been found unsatisfactory, and the use of spherical surfaces at the electrodes has been shown to give a satisfactory and very definite measurement. Data were presented at the convention which will serve for the calibration of such air gaps between spheres, and this method of measurement, at least for voltages above 50,000, will become standard. In addition to the shorter gap required with spheres, which is an advantage for high voltages but a disadvantage for low ones, the spherical surfaces may be used repeatedly without renewal, and with specimens of insulating materials to be tested connected to the circuit. The determinations are, moreover, independent of the humidity of the air, although, as in all cases of air-breakdown, dependent upon temperature and pressure.

THE TESTING OF TRANSFORMERS.

The present Standardization Rules require that the copper loss in transformers shall be determined at the temperature corresponding to maximum load. It developed at the convention that this practice is not uniformly followed by manufacturers, and that measurements of copper loss by resistance or by wattmeter are frequently made at room temperature. Since the temperature co-efficient of copper is well known, such a result can be easily translated into terms of temperature under load, but this is not always done, and guaranteed efficiencies are frequently based upon values of copper loss ascertained for room temperature. Such efficiencies are, of course, not realized in service, where the results are less advantageous. On the other hand, when efficiencies at fractional loads are expressed in terms of copper loss at the maximum operating temperature, there is a discrepancy upon the other side. One of the principal things to be accomplished by a set of standardization rules is uniformity in such matters as this, and whatever the recommendations of the new rules may be, it is to be hoped that they will be followed generally in practice, so that there may be no confusion as to what a statement of transformer efficiencies may mean. With uniformity in expressing these values, no misunderstanding can result, and the efficiencies to be actually attained in operation may then be computed by anyone for the actual conditions of operation. This should be one of the aims of all standardization and uniform ratings; not that the rating should represent the proper load under multifarious conditions of service, or that the stated efficiencies should represent actual efficiencies, but they should give information in such a form that a user may interpret them and compute their equivalents under the particular conditions of his own service.

MAKING THE SMALL OFFICE REPRESENTATIVE.

The importance of the office as the front door of the modern central-station organization may appear greater in a city property than at the headquarters of a small local plant, but in reality the benefits of maintaining a representative and businesslike company home are just as much worth while for the little station as for the big one.

Clean, well-lighted premises, with exhibits of energy-consuming devices that are regularly changed, are easily obtained in these days. Whether the town boasts of a single electric sign burning between dusk and midnight, the local lighting company can set the example of enterprise in this direction at very little cost to itself if it will utilize low-candlepower tungsten lamps in the service. Pains can be taken to keep its own window lighting free from dust and in accord with the best ideas regarding glare prevention, and if the merits of simple window dressing are grasped, it is surprising how much good publicity can be secured by rotating exhibits. One or two electric irons mounted in realistic fashion on an ironing board with some delicate fabric beneath will do very well for the central display one week; the next week the possibilities of the small motor may be shown by exhibiting some machine of local interest direct-driven by electricity; and later, a couple of art glass lighting shades may be displayed against a tasteful cloth background with a few good books scattered about as a hint of the comforts of reading by these beautiful types of shades. Too often the local manager crams his display window with miscellaneous apparatus in an effort to show off all his treasures at once, and again, the power of suggestive displays is often overlooked. Carefully prepared cards explaining novelties in outline and inviting the passerby into the office for further demonstration cost little to prepare, yet their use is often utterly neglected. It is not too much to say that the small central-station office located on the principal street of its local community has in many cases a really wonderful opportunity in front of it to raise the standards of pretty much all the business establishments on the thoroughfare within many rods of its door so far as lighting and businesslike appearances are concerned.

Within doors old and inefficient methods of handling bills, cash and correspondence, of filing data and of preparing drawings and necessary papers should give way to clean-cut and orderly practices. By the introduction of simple card index and loose-leaf systems if the company cannot afford extended changes the whole line of attack on the company's problems can be changed. Accumulations of years can be eliminated or transferred to other places out of public view at little cost, and in a word, the modernization of the premises can be accomplished without sacrificing a bit of the accessibility of the manager, which is so important a factor in the local relations of a small company, provided the man responsible for the public relations of the concern looks upon the improvements as a means to an end and does not attempt to set up a bureaucracy with the advent of new methods. There is not the least doubt that external signs of a businesslike conduct of affairs add weight to the recommendations of the company concerning the economies of electric service and its general benefits.

DATA ON UNDERGROUND SYSTEMS.

On another page of this issue announcement is made of an enterprise which will be pushed by G. M. Gest, the eminent contractor and engineer, for the securing of certain data with regard to the extent and characteristics of conduit installations throughout the country. Mr. Gest has undertaken the work of compiling these data on behalf of the National Electric Light Association at his own expense. The Association is anxious that all of its member central-station companies co-operate fully by sending in the simple data asked for. It is to be hoped that this generous illustration of co-operation upon the part of the Class D manufacturing members of the Association will meet with the hearty co-operation of the member companies, and that there will shortly be available a mass of exact data relating to this important phase of electrical distribution.

The Work of the Underwriters' Laboratories.

William H. Merrill, Jr., manager of the Underwriters' Laboratories, Chicago, interestingly outlined the work which this organization is doing in an address before the Electric Club of Chicago, on February 27. In his introductory remarks Mr. Merrill stated that the Underwriters' Laboratories, with the National Board of Fire Underwriters, is in sympathy with the present agitation for a reduction in the enormous fire loss sustained each year in this country. This loss, which amounts to some $250,000,000 annually is due to many causes, but principally to the carelessness of the American people. As an indication of the extent to which the Underwriters are going to reduce this vast loss, Mr. Merrill stated that from $60,000 to $70,000 a year is being spent in investigating and reporting on the efficiency of various cities from the fire-protection standpoint.

The work of the Underwriters' Laboratories represents only a small portion of the work being done to lessen the number of fires. This work is in itself, however, of enormous proportions. Mr. Merrill stated that about 15 per cent of the work of this institution related to the electrical industry and he asked for further co-operation from the electrical industry in bringing electrical products up to a high standard of efficiency from the standpoint of fire risk. Mr. Merrill stated that the co-operation already extended has made possible the drawing up of the National Electrical Code, which is a set of specifications that are adhered to by more people than any other engineering specifications known. During the past year 100,000 copies were printed and distributed.

Mr. Merrill briefly outlined the methods of inspection that led up to the present label system, which is now universally used, and which gives indications of rapid development. During the past year it is estimated that 30,000,000 labeled articles were manufactured by electrical manufacturers. As an outcome of this label system Mr. Merrill referred to the conditions governing the manufacture of rubber-covered wire wherein not only do the manufacturers have to meet certain standards in the manufacture of their product but tests are made of the wire under various service conditions. These performance tests are recorded, tabulated and sent to the manufacturer so that he may see how his product compares with that of his competitors. This feature of investigating the performances has been so successful in the rubber-covered wire field that Mr. Merrill feels it will be extended to cover other products.

Following the address by Mr. Merrill, the matter of permanent quarters for the Club was taken up. The committee appointed at the previous meeting to investigate further the various financial details involved, reported through N. F. Obright that the original plan to lease the old quarters of the Hamilton Club was feasible and recommended that such action be taken by the Club. Final vote was deferred until the meeting of March 6, so that all members could be fully acquainted with the details.

Franklin Institute Awards of the Elliott Cresson Medal.

Franklin Institute, Philadelphia, acting through its Committee on Science and the Arts, has recently awarded the Elliott Cresson gold medal, the highest honor in the gift of the Institute, to the following:

Charles Proteus Steinmetz, A. M., Ph. D., of Schenectady, N. Y., in recognition of successful application of analytical method to the solution of numerous problems of first practical importance in the field of electrical engineering.

Emile Berliner, of Washington, D. C., in recognition of important contributions to telephony and to the science and art of sound-reproduction.

Isham Randolph, D. Eng., of Chicago, Ill., in recognition of distinguished achievement in the field of civil engineering.

John William Strutt, Baron Rayleigh, P. C., J. P., D. C. L., LL. D., F. R. S., Hon. C. E., Sc. D., of Witham, Essex, England, in recognition of extended researches of signal importance in physical science.

Sir William Ramsay, K. D. B., LL. D., D. Sc., M. D., Ph. D., F. R. S., F. C. S., of London, England, in recognition of numerous discoveries of far reaching importance in the science of chemistry.

Emil Fischer, Ph. D., M. D., D. Sc., F. R. S., of Berlin, Germany, in recognition of numerous contributions of fundamental importance to the science of organic and biological chemistry.

Program for Convention of Minnesota Electrical Association.

The Minnesota Electrical Association, as announced in these columns, holds its annual convention at the St. Paul Hotel, St. Paul, Minn., March 11, 12 and 13.

The program of papers is as follows: March 11, morning session; (1) Report of the secretary-treasurer; (2) Committees reports; (3) President's address; (4) General business. Afternoon session; (1) "The Central-Station Manager as a Promoter of his City's Interests," Ludwig Kemper, Minnesota Gas & Electric Company, Albert Lea, Minn.; (2) "Prevention of Accidents," by D. D. Lexcohier, of the Minnesota State Labor Bureau.

March 12, morning session; (1) "Increasing Power-Plant Efficiency," by a representative of the General Electric Company, Schenectady; (2) "Central-Station Sales Methods," by C. E. Van Bergen, Duluth Edison Company, Duluth, Minn. Afternoon session; (1) "The University and the Central Station," by George Shepherdson, of the University of Minnesota.

March 13, morning session; (1) "Report of a Diesel Oil Engine Test," by E. A. Aspnes; Monteviedo Electric Light & Power Company; (2) Election of officers.

The various entertainment features provided include a dinner on Wednesday evening and various inspection trips. Eugene Holcomb of St. Paul is president of the Association, and E. F. Strong, Chaska, secretary-treasurer.

Michigan Section Convention.

At a meeting of the Executive Committee of the Michigan Section, National Electric Light Asociation, held recently, it was decided to hold the next annual convention at the Ottawa Beach Hotel, Ottawa Beach, Mich., August 19, 20 and 21. This association for the past two years has held its annual conventions on shipboard but it was found that many members did not wish to be kept away from their place of business for three or four days as was necessary. The location selected for the next meeting is situated on the Eastern shore of Lake Michigan, giving all the advantages of boating, fishing and bathing, while there are numerous amusement parks in the immediate vicinity and convenient golf links and tennis grounds. Herbert Silvester, 18 Washington Boulevard, Detroit, is the secretary.

Section Meeting in Pittsburgh.

At a banquet of the Duquesne Light Company Section of the National Electric Light Association held in the Palm Garden of the Rittenhouse Restaurant, Pittsburgh, Pa., February 28, nearly 300 members and guests attended. During the evening nomination for officers for 1913 were made as follows: For president, C. L. Ward, J. S. Sloan and G. F. Barrows; for vice-president, R. M. Patterson, C. M. VanWickle and E. J. Griffen; for secretary, C. E. Ebbers, J. L. Geary, D. P. Lockhart; for treasurer, E. F. Harper, Fred Lehman and F. H. Stone; Executive Committee, E. H. Busher, C. W. Crider, Henry Harris, H. L. Fullerton, A. E. Ecklund, Howard Heslip, J. F. Martin, R. H. Rughen and William Riley.

Isham Randolph.

While not directly connected with the practice of electrical engineering, Isham Randolph has been a prominent factor in many important enterprises depending, in a great measure, for their successful outcome upon the utilization of electrical energy and the coordinating of the the work of the civil engineer and the electrical engineer.

Isham Randolph was born at New Market, Clark County, Virginia, in 1848. His education, both general and technical, was acquired in the school of experience. He entered the service of the Baltimore & Ohio Railroad in 1868, going to the Lehigh Valley Railroad three years later.

In March, 1872, Dr. Randolph re-entered the service of the Baltimore & Ohio Railroad and later was resident engineer for a part of its western system. From 1876 to 1885 he had an extensive experience in the building of railroads, railroad terminals and freight houses in the western section of the country.

In this latter year he opened an office for general engineering work in Chicago. In 1886 he was employed by the Illinois Central Railroad in the location and building of the Chicago, Madison & Northern Railroad and the Freeport & Dodgeville line, as chief engineer. In 1888 he resumed the general practice of engineering in the city of Chicago and was employed as engineer on various projects and later as consulting engineer for the Union Stock Yards & Transit Company and the Baltimore & Ohio Railroad Company.

On July 7, 1893, he was elected chief engineer of the Sanitary District of Chicago, and he served in this capacity for 14 years, during the entire period of construction of the Chicago Sanitary and Ship Canal, a project costing some sixty millions of dollars. He retired as chief engineer in 1907, and has since served the Sanitary District as consulting engineer.

He was appointed by President Roosevelt on the Board of Consulting Engineers for the Panama Canal, and was one of the five members of the board whose minority report was accepted by the President and Secretary of War, approved by the Panama Commission, adopted by Congress, and the canal is now being constructed in accordance with its recommendations.

In 1908 President Roosevelt invited him to be one of the six engineers whom he wished to have accompany President-Elect Taft to Panama to consider "whether or not there is any reason to change the plans upon which we are working." This board of engineers submitted its report to the President on Tuesday, February 16, 1909, unanimously upholding the plans for the lock canal across the isthmus.

Dr. Randolph recently served the City of Milwaukee as consulting engineer on its harbor project and prepared comprehensive plans for harbor improvement there.

Isham Randolph,
Consulting Engineer for the Sanitary District, Chicago.

He was chairman of the Internal Improvement Commission of Illinois, which commission was charged with the duty of planning the deep waterway from Lockport to Utica, for which the State voted an issue of twenty million dollars in bonds. He is a member of the Illinois State Conservation Commission. He is a member of the Harbor Commission of the City of Chicago, and is consulting engineer for important engineering projects in Toronto, Canada; Buffalo, N. Y.; and Baltimore, Md., besides other minor projects in various localities. He is a member of the Rivers and Lakes Commission of the State of Illinois.

In 1910, the University of Illinois conferred upon him the degree of Doctor of Engineering, and now the Franklin Institute has awarded him the Elliott Cresson gold medal.

He is a past-president of the Western Society of Engineers and a member of the American Society of Engineers.

Public-Utility Situation in Louisville.

A counter proposition which may give H. M. Byllesby & Company, of Chicago, the right to acquire control of public utilities in Louisville, Ky., has been made to the Chicago capitalists by Mayor William O. Head, of Louisville. Mayor Head recently rejected an offer of the Byllesby interests to furnish fuel gas in Louisville at 35 cents per thousand feet with a 50-cent service charge. Mayor Head's return offer is understood to embody features which will give all consumers of more than 2,000 feet of gas per month at the 50-cent rate, while smaller consumers will secure their fuel even cheaper than this rate. It is predicted in financial circles in Louisville, that the parties involved will not be long in agreeing upon terms. In that event a franchise permitting the Byllesby interests to enter the city with cheap gas will be granted, and it is understood that ordinances giving this privilege are even now being prepared. Besides securing the gas franchise, the Byllesby company will be permitted to buy the Kentucky Heating Company and the Kentucky Electric Company, thus gaining control of the Louisville utility field. It is claimed in Louisville that the purchase of the Kentucky Heating Company has already been effected and that only the formal transfer of stock is yet to be made, while the standing of the Kentucky Electric Company in the case is very difficult to determine.

New Boston Edison Substation.

The Edison Electric Illuminating Company of Boston has bought 6,000 feet of land on Stuart Street, near Park Square, Boston. The Company will erect a six-story substation to serve a territory about a mile in diameter. The cost will be between $300,000 and $400,000. The first floor will be used for machinery, the second for switchboard purposes, the third and fourth for storage batteries, and the fifth and sixth floors will be in reserve for future uses.

Philadelphia Section N. E. L. A. Activities During February.

The regular February meeting of the Philadelphia Electric Company Section of the N. E. L. A., was held in the Franklin Institute, February 17, 1913. Preceding the meeting many of the members and visitors participated in a dinner at the New Bingham Hotel. E. L. Kyle, a visitor representing the Westinghouse Company, Joseph G. Johnson, secretary of the Meter Department Branch, and Edward Hulley, chairman of the Entertainment Committee, contributed a number of interesting selections on the piano.

Under the direction of James T. Maxwell, chairman of the Assembly Room & Exhibition Committee, the Minerallac printometer devices, and the Alpha-Bet electric letter sign purposes were demonstrated by F. J. Furman and E. S. Pelling, respectively. These demonstrations are a feature before the regular lecture of the evening and have proven successful.

After the demonstration, B. Frank Day, chairman of the local Section, presiding, introduced E. E. F. Creighton, of Union College, Schenectady, N. Y., who delivered a very interesting lecture on "Protection of Electrical Circuits and Experiments in High Frequencies." Professor Creighton dealt with this abstruse subject in a masterly, yet simple and convincing, manner. Many unique charts were displayed, illustrating the points of the lecture. A very large array of apparatus demonstrating the theory of this subject was utilized to good advantage.

The traveling electric wave, the stationary wave, displacement current, stress, surges and many other points in connection with this subject were dealt with in an interesting way. Professor Creighton illustrated what actually takes place on a line by two mechanical analogues, one with a wire rope and another with specially constructed machine by which the waves are made to travel in a manner similar to those in the electric circuit. He also showed an electric impulse traveling along a circuit by means of a specially constructed apparatus which he had arranged.

Several types of lightning arresters were shown and their design and construction explained. A very interesting and profitable discussion followed the lecture, Messrs. Schick, Lloyd, Seaman, Donley, Matthews, Calvert, Cheyney, Albrecht, Liversidge and W. C. L. Eglin, taking part in the discussion. George Green spoke of the unique character of the lecture and of the simple manner in which it was treated, and moved a vote of thanks to Professor Creighton and his assistant, Mr. Atkinson. Mr. Green stated that anybody can explain a thing so that nobody can understand it, but a man must know his subject in order to explain it so that anybody can understand it.

The February meeting of the Meter Department Branch was held Friday evening, February 7, 1913, 91 members being present and most of them participating in a very profitable discussion following the paper.

The paper of the evening was presented by J. Bert Mills, production manager of the Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind. Mr. Mills' paper was profusely illustrated with many interesting lantern slides and consisted of a pictorial review of the many operations necessary in the production of the modern watt-hour meter. Each step in the manufacture was thoroughly explained and all of those present were impressed with the magnitude of the work of this character and the unique way in which Mr. Mills has carried out the many salient features of production management. Mr. Mills spoke of the development of modern machinery for producing uniform and efficient product and gave members some valuable data relative to design and manufacture of a modern watt-hour meter. Messrs. Donley, Pfaff, Milliken, Pickles, Strattner, Currier, Seaman, Hawkes, White, Ploetz, Duus, and Coe participated in the discussion.

The usual luncheon followed the meeting and was very much enjoyed.

The February meeting of the Accounting Department Branch was held in the Library, 1000 Chestnut Street, February 11. G. Walker Spahr, special representative of the Tabulating Machine Company, New York City, read a very valuable paper on the "System of Cost Accounting" that he designed and installed at the plant of a large steel company. An interesting discussion followed the reading of the paper and the spirit of inquiry was shown to be growing among the men in this branch.

The Accounting Department Branch instituted at this meeting a series of efficiency questions. A set of ten questions referring to the work of the department and to bookkeeping in general, will be gotten up for each meeting. Each member will be required to answer each question and a committee will go over the questions and mark them, rating each member according to the percentage he has merited. At the end of the year an average will be struck and the men securing the highest average will secure a suitable prize. This system is a unique one and is worthy of much more comment if space would permit. Frank A. Birch, 1000 Chestnut Street, is chairman of the committee and further detail regarding this system of education my be obtained from him.

The February meeting of the Commercial Department Branch was held on February 24, in the Library, 1000 Chestnut Street. The paper of the evening was on "The Electric Vehicle," by J. Crawford Bartlett, of the Woods Electric Garage. He gave a complete and valuable history of the entire life of the electric vehicle, both pleasure cars and trucks, and the talk was illustrated with lantern slides showing the different stages of progress made in electric vehicles since the first one appeared on the market.

Philadelphia Section Meeting of Illuminating Society.

The February meeting of the Philadelphia Section of the Illuminating Engineering Society was held on February 21, 1913, at the Engineers' Club, 1317 Spruce Street.

At the dinner preceding the meeting, which was held in the dining-room of the Engineers' Club, 46 members and guests were present.

The meeting was called to order by the chairman, Prof. Rowland, at 8 o'clock p. m., with 175 members including a number of architects and opthamologists present. The secretary read the minutes of the January meeting, also abstracted the council meeting of January 10 and made a statement of the subjects of meetings of other sections for the month of February.

Prof. Rowland introduced the speaker of the evening, P. S. Millar, President of the Society, who spoke on "Some Phases of the Illumination of Interiors." The discussion was entered into by Messrs. Perot, Bond, Regar, Hare, Dickey, Swanfeld, Israel, Prof. Hoadley and Dr. Crampton.

Tacoma Jovian League.

The regular meeting of the Tacoma Jovian League was held at the Olympus Inn, February 18. The meeting was addressed by E. J. Barry, consulting electrical engineer of the St. Paul & Tacoma Lumber Company, on "The Electrification of Woodworking Plants." Mr. Barry's talk was informal, giving his experience while electrifying the system of the Potlach Lumber Company, of Potlach, Idaho, dealing more specially with electricity as applied to logging operations.

Afterwards there was an informal discussion of this subject by Mr. Fellows, motor specialist of the General Electric Company, and Mr. Schluss, of the Tacoma Railway & Power Company.

The next regular meeting of the Tacoma Jovian Luncheon League is scheduled for March 4.

The Commercial Side of a Small Hydroelectric Property.

An investigation of conditions of power companies, supplying five small towns aggregating 5,500 population, made with a view to improving the electrical service, showed that with an additional small outlay the investment could be made to produce satisfactory returns. The methods pursued are given in this article.

The analysis and data in the following paragraphs are based on an investigation recently made with a view of improving the electrical service in five small neighboring towns with a total population of 5,500, situated in a river valley in one of the eastern states. Three towns are served by the "A" Power Company, which has a hydroelectric plant with a connected load of approximately 100 kilowatts of commercial lighting, and the other two by the "B"' Power Company, with a capacity of 20 kilowatts. A large proportion of the load is taken by summer hotels requiring the requisite amount of electricity during the low-water periods. The output of the "A" Power Company often falls below 70 kilowatts, with resulting unsatisfactory service.

There are several saw, spool and peg mills in two of the towns, and a canvass of the mills showed a field for electricity for power purposes amounting to about 250 kilowatts on a ten-hour basis, during the entire year. A local demand of approximately 400 kilowatts is assured if the power can be supplied continuously, particularly in the summer months.

The present development of "A" Power Company's plant comprises a maximum street-lighting load of 15.4 kilowatts in summer and 15.4 kilowatts in winter, and a commercial lighting load of 95.2 kilowatts in summer and 65.8 in winter. The maximum load on "B" plant comprises, 2.1 kilowatts, summer and 2.1 kilowatts, winter, street lighting; and 22.5 kilowatts summer and 15.7 kilowatts winter, commercial lighting. The total for both companies is 135.2 kilowatts in summer and 99 kilowatts in winter.

It was assumed that the existing street lighting would be increased 100 per cent as it was very inadequate, and the commercial summer load, 30 per cent as it seemed probable that several hotels could be obtained as customers, and that the larger mills would contract for power at the start. The results of the above assumptions are as follows:

	Kilowatts, Summer	Kilowatts, Winter.
Street lighting	35	35
Commercial lighting...	153	90
Mill power	160	160
Total	348	285

The investigation showed that the probable ultimate maximum load would be confined to the upper portion of the river, as numerous good sites on the lower river are available which would be preferable to supply towns close at hand. Nearly all the hotels and residences are at present connected, and the rate of population increase is low; on this basis the probable ultimate maximum of development is as follows:

	Kilowatts, Summer.	Kilowatts, Winter.
Street lighting	35	35
Commercial lighting...	190	110
Power	260	260
Total	485	405

The probable ultimate maximum summer peak of 485 kilowatts or 650 horsepower includes the power now being unsatisfactorily supplied by the existing plants, and thus assumes that these systems will be absorbed. The attempt was made in the plan of development to utilize the natural flow of some river in the vicinity without auxiliary steam power, excessive storage, or high hydraulic construction cost. Twelve hundred gross horsepower of the water seemed a conservative estimate of the power necessary. This represents a total efficiency of 54 per cent, a figure which by comparison with existing plants seems conservative.

Hydrography. The rivers in this vicinity are flashy in character. The underlying rock is generally granite, and the conditions of vegetation and forests range from barren mountain tops to dense spruce growth. The United States Geological Survey has established a gauging station on the main river just below the group of towns under consideration, and a study of the records for five years showed that 0.28 cubic foot per second per square mile was the lowest minimum flow.

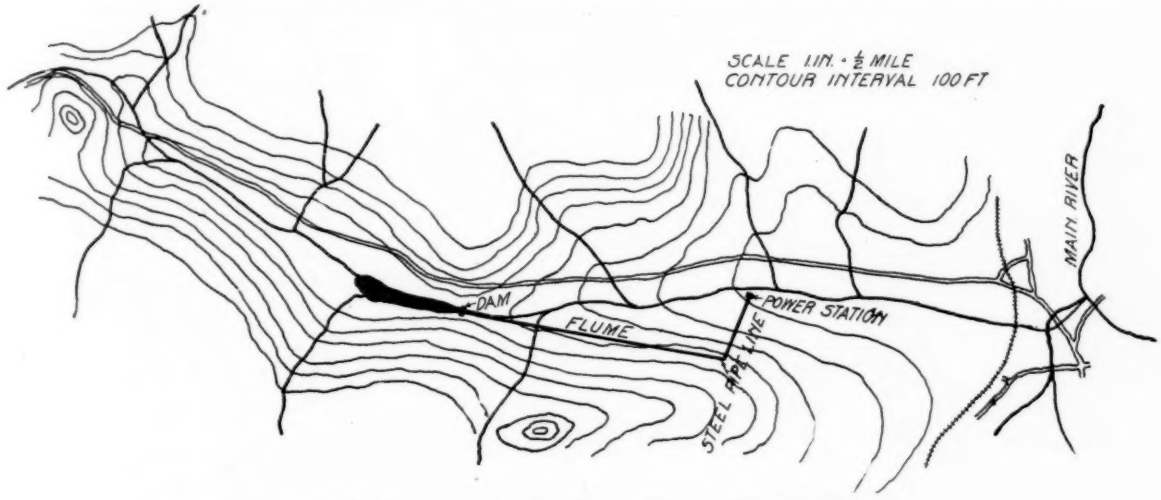


Fig. 1.—Plan Showing Location of Dam, Flume and Power Station.

Rainfall records for a period of 23 years taken in a different drainage basin only 25 miles distant and at the same altitude were available, and mass curves of precipitation for the years of least rainfall since the establishment of the station were drawn. The longest drought for the replenishing period occurred during one year for which there were run-off data, and it seemed justifiable under the above considerations to use 0.30 second-foot per square mile for the preliminary calculations.

Available Power. A tabulation of the drainage areas, calculated run-off, assuming 0.30 second-foot per square mile, and the necessary head for 1,000 gross horsepower at low water was made of the main river and six branches emptying into

it within a distance of 20 miles, and an investigation of two of the streams with the necessary head showed that there was only one site where entire hydraulic service was possible. The river in question rising on mountain slopes at an altitude from 3,000 to 4,000 feet and draining a generally forested area has a catchment basin of 91.1 square miles. A stretch of flat land located in the upper reaches offers natural ground water storage, and tends to reduce the flashy character of the stream. There is a fall of more than 600 feet in five miles, and the requisite head was obtained at the last drop of 300 feet, occurring in about 1.5 miles where cheap land and proximity to a railroad station made the selection of the site desirable. Using the estimated minimum flow of 0.30 second-foot per square mile and the drainage area of 86.4 square miles a minimum flow of 26 cubic feet was obtained.

Storage. The minimum available horsepower assuming a 300-foot head is sufficient to supply the immediate demand, and a flow of 35.2 second-feet is required to maintain 1,200 horsepower. It was assumed from the nature of the load that the use of water in excess of the minimum flow would not extend over a period of more than four hours. The plant would not be expected to supply all-night service, and five hours each night would be used for storage, giving 468,000 cubic feet nightly for a low-water run-off. It would take 14 hours to draw off this nightly storage if the water was used at the ultimate maximum value. A storage capacity of 400,000 cubic feet is about three times the amount required, allowing for leakage, evaporation and unforeseen conditions. Estimated contour drawn on a 100-foot contour state map showed that a dam about 120 feet long and 8 feet in height would flood an area of approximately 60 acres, giving storage capacity of 10,000,000 cubic feet which is greatly in excess of the required amount.

Hydraulic Development. A timber crib dam was recommended on account of its cheapness, facility of construction, and the fact that timber was close at hand. The river bottom at the dam site is principally gravel with an underlying bed rock. It was found that the dam need not exceed five feet in height for immediate installation as the minimum flow is able to furnish the expected maximum load. An estimate based on existing timber crib dams showed 23,000 board feet needed for a height of five feet.

A closed-timber flume 9,500 feet in length, and a steel-pressure-pipe line about 2,600 feet long conducting the water down the steep hillside were recommended. It was found advisable to place the end of the flume about 15 feet below the intake at the dam. Using two-inch planking 340,000 board feet are needed in the construction of the flume. A 33-inch riveted-steel hydraulic pipe gives a velocity of 6 feet per second, and a lost head of 12.6 feet. The total lost head from dam to power station is 13.4 plus 12.6 feet. The minimum effective head taken from a contour map is 302 feet,

Fig. 2.—Transmission Lines of the Two Companies.

which shows that the assumed head of 300 feet was correct for these calculations. The pipe line would be divided into four sections of different thickness dependent on the pressure and a relief valve was found necessary to take care of excessive pressure at the lower end of the pipe line.

Power Station Layout. A simple power station so arranged that an extension can be easily effected is shown in the accompanying sketch. A Pelton wheel equipped with a combination of needle and deflecting nozzle and automatic governor was recommended on account of the advantages of the Pelton system for such an installation.

The equipment of the present lighting system consists of alternating-current 60-cycle apparatus, necessitating the use of generators of similar frequency. Transmission would be at 5,000 volts, and distribution at 2,300 volts, as in the present system. On account of the proximity of "B" Company's plant, electricity would be generated at 2,300 volts connecting the feeders with the bus. Assuming 75-per-cent efficiency from the switchboard to motors inclusive and an 0.8 power-factor, the maximum ultimate output at switchboard with the maximum peak of 650 horsepower would be 755 kilovolt-amperes. As the ultimate probable peak is of such short duration, it was assumed that the machines would be 50 per cent overloaded at this point, and three generators of 175-kilovolt-ampere capacity were recommended. The following equipment was decided upon to fulfill the above requirements. Waterwheel performances were based on the manufacturer's guarantee. The exciter capacity is ample to furnish lighting to the station, and reserve a spare unit at all times.

Equipment. Two standard Pelton water wheels, four feet diameter, double nozzle, needle and deflecting type; 624 horsepower, 305 revolutions per minute. Amount of water used 21.5 cubic feet per second.

Two standard 175 kilovolt-ampere alternating-current generators; 2,300 volts, 60 cycle, 3-phase, 24 poles, 300 revolutions per minute.

Two 25-kilowatt, direct-current exciters, 220 volts, 110 amperes, 4 poles, 600 revolutions per minute.

Two standard Pelton water wheels (for exciters), 18 inch diameter, single-nozzle deflecting type, 39 horsepower, 610 revolutions per minute. Amount of water used 1.3 cubic feet per second.

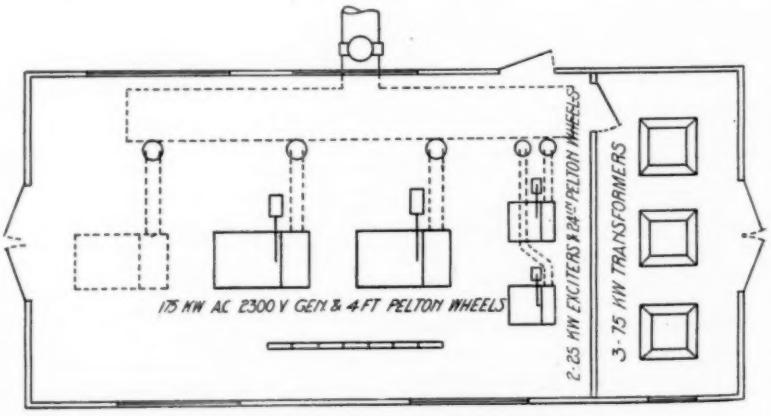


Fig. 3.—Proposed Layout for Power Plant.

Total maximum quantity, 22.8 cubic feet per second. The addition of a similar unit gives the following: 33.8 cubic feet per second, and 935 horsepower. Total ultimate quantity, 33.8 plus 1.3 is 35.1 cubic feet per second. For the intial

installation, the water consumption is under low-water flow.

Transmission. "A" and "B" companies' present lines are shown in Fig. 2, and the necessary additions are shown by the dotted lines. All existing circuits are single phase with transmission at 5,000 volts, and distribution at 2,300 volts. An inventory of all lines was taken, and it was considered advisable to repair the present lines and put them in service for three-phase operation, and to eliminate several lines on the poles. Proposed lines are shown in dotted on the sketch. The power load at "B" would be supplied at 2,300 volts direct from the buses, and stepped down for the motor service. A 5,000-volt line would be run to supply the lighting load and small-motor service in the "A" Company's territory. It was estimated that transformer capacity amounting to 200 kilowatts for power and 40 kilowatts for lighting would be required on the above lines for the immediate installation.

Transformers. A set for one feeder only is necessary, and the total capacity to serve the ultimate load is approximately 225 kilowatts. Three single-phase transformers were recommended instead of a three-phase unit.

COST ESTIMATE.

1. **Dam.**		
Timber, and foundations, 5 feet high, 80 feet long, at $8.00 per linear foot.	$ 640	
Filling, 60 cubic yards at $0.35	20	
65 acres of bottom land to be flooded, at $5.00	325	
Labor	1,200	$ 2,185
2. **Flume.**		
340,000 board feet, $15	5,100	
Construction	2,700	7,800
3. **Pipe Line.** (Riveted steel.)		
800 feet No. 12, at $3.00	2,400	
340 feet No. 10, at 3.90	1,320	
600 feet No. 8, at 4.50	2,700	
900 feet No. 6, at 5.50	4,950	
Laying	2,600	
Gates, anchors, etc.	1,250	15,220
4. **Power House.**		
Building (erected)	6,500	
Hydraulic Equipment.		
2—4 ft. wheels and settings	1,600	
2—24 inch wheels and settings	500	
Piping	500	
Electrical Equipment.		
2—175 kilovolt-ampere generators (placed), at $15.00	750	
Switchboard complete	625	
Cables and conduits	400	
Lightning protection	350	
Transformers 225, at $4	900	12,125
5. **Transmission.**		
2 miles, 3 wires, No. 8.		
100 poles (placed), at $3.75	375	
200 cross arms (placed), at $0.75	150	
600 insulators, at $0.50.	300	
1,600 lbs. copper wire, at $0.25	400	
Wire strung, at $2.00 per pole	200	
Line, 6 miles, 3 wires, No. 8, same unit prices as above	2,750	
13 miles, 1 wire, No. 10.		
620 insulators, at $0.50.	310	
2,160 pounds copper wire, at $0.25	540	
Wire strung, at $0.75 per pole	465	5,490
6. **Distribution.**		
Transformers.		
475 kilovolt-ampere	2,300	
Service connections, 50, at $10	500	2,800
7. **Existing Properties to be acquired.**		
Power house ("A" Co.) with timber dam, 150-kilowatt generator and exciter, and 250-horse-power turbine	$5,500	
Transformers, 100-kilowatt, at $4	400	
1,179 poles, at $2	2,360	
4,870 insulators, at $0.25	1,220	
1,662 cross arms, at $0.30	500	
14,000 pounds wire, at $0.25	3,500	
"B" plant complete, 20-kilowatt, at $75	1,500	14,980
8. **Engineering.**		
Legal, land and water rights, 400 kilowatts, at $25		10,000
First cost		$70,600
Allowances for contingencies, 10 per cent		7,060
Total first cost (say)		$77,700

ANNUAL OPERATING COST.

2 operators, at $1,000	$2,000	
1 assistant	720	
1 lineman	720	
Incidentals	600	
Maintenance, $77,700, at 2 per cent.	1,554	
Depreciation, $77,700, at 5 per cent.	3,885	
Taxes, $77,700, at 1 per cent	777	
Insurance, $77,700, at ½ per cent	388	
	$10,664	

INVESTMENT BALANCE.

Charges.		
Interest at 6 per cent on $77,700	$4,662	
Total operating cost	10,664	$15,326

REVENUE.

Load-factor for winter, 60 per cent.
Maximum peak, 195 kilowatts.
Load-factor for summer, 43 per cent.
Maximum peak, 288 kilowatts.
Revenue at $0.01 per kilowatt-hour (325 days).
Winter, 162.5 by 24 by 195 by .60 by $0.01 = $4,563
Summer, 162.5 by 24 by 288 by .43 by $0.01 = 4,830
(say) $9,400

Revenue.	Price per Kilowatt-Hour.	Surplus.
$ 9,400	1.0 cent	$ 5,926 deficit
14,100	1.5 cents	1,226 deficit
18,800	2.0 cents	3,474
23,500	2.5 cents	8,174
28,200	3.0 cents	12,874
32,900	3.5 cents	17,574
37,600	4.0 cents	22,274

KILOWATT-HOURS PER DAY.

Summer, 2,960
Winter, 2,820

The actual selling price for power or classification of rates could not be accurately determined without the more detailed specifications that would accompany the final investigation. The proposition looks attractive at an average selling price of three cents per kilowatt-hour.

Commercial Practice
Management, Rates, New Business

PERSEVERANCE IN SOLICITING.

Experiences of a Central-Station Salesman.

The secret of the successful power or light salesman lies in his perseverance in following up prospects. A central station considers each unwired house a prospect, and, necessarily, each plant using power is placed on its card-index file and is classified as a prospect.

The solicitor who meets with a rebuff at his first or even second call, must not despair as long as he is satiated with the main requisite of a salesman—enthusiasm.

The representative of a central station who approaches the isolated plant and after comparing the cost of generating its own power as against the cost of purchased power, comes to the conclusion that rates of the power company are too high and that the manufacturer would lose money by contracting for power, had better abandon the prospect as he will never succeed in selling an article of whose merits he is not thoroughly convinced.

Mere enthusiasm, however, does not suffice. The solicitor who happens to be an engineer and who is well able to calculate the cost of operating an isolated plant, usually has to rely upon data, furnished him by the management.

It is not within the scope of these remarks to discuss here the fallacy of blindly accepting the data furnished by the prospect. Suffice to say that the experienced solicitor will, after studying the data submitted and comparing them with reliable data as furnished for instance by the National Electric Light Association, quickly point out wrong statements and without arousing any animosity suggest proper fig-

ures for those submitted. But after all calculations are completed, and central-station power is shown to net a substantial saving, experience has shown that the prospect still hesitates before accepting a contract. In such a case, mere routine calling will not result in a contract. The solicitor will have to resort to various methods, varying his arguments as the conditions seem to justify.

The most frequent mistake made is to approach a well "worked" customer in a languid manner, as if the solicitor doubts whether his calls would have the desired effect. That is why many solicitors fail. He gets familiar with the prospect, he discusses general topics and just before leaving may ask in a haphazard way, "Well, I suppose you have not decided yet as to the advisability of installing electric power?" Such a question can only be answered in one way, and that is "No." The solicitor should speak positively and leave no room for a denial. The following illustration will show how easily a prospect will lose confidence when left alone to decide on a contract: A prospect had received all statements and estimates that could be furnished and promised to sign the contract in question that evening. He even was cautious enough to have his attorney approve it. Still the contracts did not show up the next day nor the following. Over the long-distance telephone he stated that he had decided to drop the matter as he had found that with electric power his cost would be doubled. Nevertheless, he promised to see the solicitor the very same day. The solicitor called immediately, went over the same field, showed the prospect where his calculations were wrong and generally managed to get himself "in right" again. After discussing the matter for approximately two hours, the solicitor could think of no other arguments, so he suddenly presented the contract to the owner, pulled out his fountain pen and pointing to the proper place, in a serious tone, said: "Now, sign here," and without hesitation, the man signed.

Of course, this method may have a disastrous result with another prospect, but to the knowledge of the writer, this procedure has succeeded in several cases. It all depends upon the ability of recognizing the critical moment when the prospect has grasped all that had been told him, about the proposed power.

The solicitor must bear in mind that he is selling a commodity that means either a saving as in power or else comfort as in light.

Where courage is required and where real salesmanship is required, is in the case of the prospect who believes or feigns to believe every statement the central-station representative is making and still hesitates in signing the contract. Persistent calling will help, but only then when the prospect is approached with renewed enthusiasm.

As mentioned before, the solicitor easily is discouraged and in making his rounds, does not speak with enough spirit when admitted to the office of the prospect. After making the acquaintance and after completing tests and submitting all data relating to the saving of purchased power, the solicitor should not, as a rule, open the conversation with the question foremost in his mind. A few general remarks are first in order. If possible he should be prepared to mention something entirely new, that will interest the prospect. In case of a power customer, he may bring up a new phase, some newly contemplated line, that would insure continuity of service, or else he may tell about the generating-station equipment or may casually mention the number of high-grade and experienced engineers the central-station company has in its employ, whose sole business consists of improving the service, and reducing the cost of producing current and thus help in eventually reducing the rates.

The manufacturer is not an expert in making power. His business may be the making of tin cans, or castings or chairs, etc., while the solicitor is representing a concern which is a specialist in generating and transmitting energy.

Right here is a dangerous remark that should be avoided. It is wrong to say, "we can make power cheaper than you can," but rather, "we can sell power cheaper than you can make it." The customer is quick to appreciate the difference.

A magazine dealing in clever salesmanship, published a story some time ago about a cigar salesman who called on a druggist who received him very ungraciously and refused to even inspect the goods. The salesman who was "green" quietly closed his trunk and walked out. Within a month he was back again and before the druggist had a chance to say anything, he remarked, "My house insists on my calling on all our prospects, so if you don't object, I will come in once a month, so I can conscientiously report my call." To this the druggist could not object and as the story goes, the young man called eleven times, and at the twelfth call obtained an order.

Broadly interpreted, persistency won out in this case and there is no reason why persistency cannot procure business for the central-station salesman.

Some manufacturers will patiently listen to all arguments and then wind up the interview by asking for a written statement. The solicitor may ask when he would be permitted to call again and the answer may be in a week or so. While ultimately the business may be procured, it is imperative to get it quickly, and, therefore, instead of waiting a week, the solicitor could bring the requested statement, report or contract in person and thus secure another interview. It is fallacy to leave a contract with the ordinary prospect to have it signed. Of course, with big houses it cannot be avoided, but then these suggestions are not written for that class of solicitors. They are experienced men who do not need any suggestions. But the young solicitor may appreciate these notes as they will show him the many dangers and pitfalls he encounters and difficulties he has to avoid before blotting the valued signature.

No contract is secured until it is signed and in your pocket. A young lighting solicitor, who was sent out to secure housewiring contracts, recently returned to the office and remarked triumphantly that he was about to land a good contract. It developed, that he had managed to enthuse a woman, who was sure that "John" would be glad to have the house wired. Undoubtedly, the agent was a convincing talker, but in the evening when "John" retired after supper with his cigar and newspaper, the woman's enthusiasm was perfectly cooled off and she only remarked in an off-hand manner that the electric light man had called that afternoon. But John only growled and right then and there the subject was dropped. If, instead, the agent had called in the evening also and tried to convert "John," the contract may have been secured.

If a solicitor succeeds in convincing, say the superintendent, and that official has to submit the central-station's proposition to a board of directors or the general manager or the president, the solicitor should obtain permission to address the higher authority and not leave the fate of his contract in the hands of another person who naturally can not show as much enthusiasm as the central-station representative himself.

On the other hand, the agent should avoid becoming a nuisance and that is where natural tact is of primary importance. He has to "feel" the proper moment when to retire and when to keep still. Some people are not fast thinkers and require time before speaking.

The solicitor should avoid the error of the salesman, who gave his prospect a ten minute talk, and every time the "victim" tried to say something, invariably interrupted him, saying that

he still had another argument; and, when finally his breath gave out the customer remarked quietly, "Take your order book, I was ready ten minutes ago, if you had permitted me to speak."

The point here is that the agent who does not permit his prospect to answer, cannot expect success.

Ornamental Street Lighting in Cedartown.

Coincident with the paving of 2,000 feet of Main Street of Cedartown, Ga., in August, 1912, it was decided to install an ornamental street-lighting system and therefore the necessary conduit was laid while the excavation for paving was in progress.

As the curbs were 40 feet apart, posts were spaced on approximately 80-foot centers and in staggard positions, thus giving uniform illumination as well as having a post central to intersecting streets. The final installation comprised 51 ornamental posts of cloverleaf design, each carrying three lamps, one 100-watt on top and two 60-watt lamps on two arms, equipped with 12 and 16-inch Alba globes respectively.

Main Street, Cedartown, Ia., Before Old Poles Were Removed.

Energy is supplied from three transformers located in different sections of the street, maintaining a balanced load on the city's three-phase primary system. The secondary wiring is in three-wire distribution with the two bottom lamps in series at 220 volts and top lamps on 110 volts, an equal number being on each side of the neutral, thus reducing the size of the middle wire. Each post is provided with a three-pole single-branch block and the feeder posts have two single-pole knife switches arranged to cut out the bottom lamps at ten o-clock week nights and 12 o'clock Saturdays. The 100-watt lamps burn all night, consuming about the same amount of energy as the series arc lamps, which were displaced.

The feeder posts are the central ones in each circuit on opposite sides of the street, from which the feeders run to the transformers located on the intersecting streets. This arrangement permits of reduction in size of wire in each run between posts. The cost of the total installation was paid by the property owners at 75 cents per property front foot and the current included in street lighting at an additional cost to the city of one cent per post per light or 51 cents per night, extra for the white way.

In commenting on this installation, W. T. Hardy, superintendent of the Water and Light Department of the city, who designed the installation, says, "Of course each town thinks that theirs is the only White Way and so I am naturally proud of the arrangement that I have puzzled out. It is certainly one that any town or city could afford to have and to that end I will be pleased to give any information or assistance to my brother superintendents."

Hatching Chickens by Electricity.

An electric incubator of the most modern type is in operation in full view of the public in one of the big windows of the Kentucky Electric Company's Building, and much attention is focussed upon the interesting process, while there is every indication of a fine crop of birds being hatched in time for Easter.

One hundred and twenty eggs were placed in a Cyphers incubator in the window February 27, and the current was turned on, commencing a process of hatching which requires 21 days' time to complete. A careful "cost system" attends the process, for a daily record is kept of the amount of current consumed, the number of times the eggs are turned, how frequently they are cooled, and so forth, so that in the end the Ky-El-Co staff will be in a position to advise poultry fanciers fully as to methods of electric incubation.

The Kentucky Electric Company is deriving a great deal of advertising from the novel trim, and its effect will be even more accentuated when the chicks hop forth at a highly seasonable holiday.

Central-Station Electric Vehicle Exhibit.

An automobile show of its own is being staged by the Kentucky Electric Company, of Louisville, Ky., at a time when, owing to the occurrence of the annual exhibition at the Armory of the Louisville Automobile Dealers' Association, the public's mind runs largely to motor cars.

In one window of the Ky-El-Co Electric Building in the Bluegrass metropolis, a complete exhibit for the benefit of electric passenger-car owners has been installed. Every facility which a central station may afford for the maintenance of a private garage is being fully demonstated, and a number of electric appliances particularly designed for the comfort and convenience of coupe or brougham owners are shown, so that it is indeed an obtuse motorist who does not perceive the advantages of handling most of his problems at home, economically and quickly.

A rotary converter for charging car batteries, a couple of types of rectifiers for charging ignition batteries from lamp sockets, and two styles of air compressors for inflating tires electrically, are shown. In the way of minor appliances for the electrical vehicle the Ky-El-Co is showing flashlight "trouble-finders" which may be operated from ignition batteries, portable vulcanizers, a portable soldering iron and foot warmers. The entire exhibit is in charge of a factory expert who lectures informally to all visitors.

White Way for Green Bay.

After four months of unsuccessful unorganized attempts to install a White Way on their streets, merchants of Green Bay, Wis., formed the White Way Lighting Club and appointed a committee to visit Chicago with David Mac Naughton, new-business manager of the Green Bay Gas & Electric Company, to inspect the various kinds of installation in that city. This committee recommended the adoption of the General Electric Company's four-ampere luminous arc lamps and 24 of these will be installed together with 24 General Electric ornamental posts. The distance to be illuminated for the present is to blocks of about 750 feet, and the lamps will be installed at approximately 60-foot centers with four at the cross streets. The White Way Lighting Club made purchases of all necessary material including cable from the power house, and has entered into a contract with the central station to furnish current at $80.00 per month including maintenance. The lamps will burn from dusk until 12 o'clock midnight.

Electrical Construction

SOME PRACTICAL CONSIDERATIONS IN COMPUTING CONDUCTORS FOR ELECTRIC CIRCUITS.

By Anthony Gorman.

There are three factors that should be considered when determining the sizes of wires for the distribution of electricity. A wire should be of such size: (1) that it will carry the current without an excessive drop or loss of voltage; (2) that the current will not heat it to a temperature which would spoil the insulation or cause a fire; and (3) that the cost of energy lost—the I^2R loss—in the line will not be excessive. A conductor may satisfy one of the three conditions without satisfying the other two.

For a 110-volt incandescent-lamp load the conductors should be of such size that the pressure at the lamps can never vary more than three volts. Sometimes four, and even five volts' variation is allowed on 110-volt lamp circuits, but this is not good practice. Expressed in percentages, a 2.5 per cent to a 3 per cent drop represents good practice; 4.5 per cent drop is the upper limit. These are percentages of the receiver or normal lamp voltage. If the values above suggested are exceeded the life of the lamps may be shortened or they may burn dimly when the circuits are loaded.

On motor circuits a drop of 5 per cent is very good practice, and a 10 per cent drop is often permitted. If lamps are on the same circuits with motors, a 3 per cent drop should not be exceeded.

The question of voltage drop in conductors is closely associated with that of conductor economy. In important work, particularly where the cost of energy is high, the cost of the energy lost in a conductor as well as the volts lost in it should be considered.

Percentage line drop or voltage loss may be figured as either a percentage of the voltage required at the receiver or as a percentage of the voltage impressed by the generator or other energy source on the line. For instance, in Fig. 1, the voltage impressed on the load—lamps and motor—is 220. The line loss is 11 volts; hence, the pressure impressed on the line is 220 plus 11, or 231 volts. The voltage loss as a percentage of the voltage at the receiver is 11 divided by 220, or 5 per cent. Similarly, the percentage voltage loss as a percentage of the voltage impressed on the line is 4.8 per cent. In practical work the percentage loss or drop is usually taken as a percentage of the voltage required at the load, because this is the most convenient and direct method. In this article the term "percentage drop" refers to a percentage of the voltage required at the receivers unless otherwise noted.

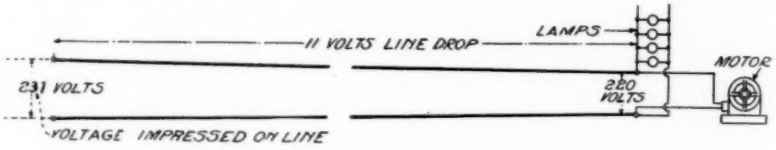


Fig. 1.—Diagram Illustrating Voltage Drop in Line.

To ascertain the volts drops as a percentage of the volts impressed on the line, use the following:

$$v = \frac{p\,V}{100} \times \left(1 + \frac{p}{100}\right)$$

where v = volts drop, or loss in line; p = percentage drop of the voltage impressed on the line; and V = voltage at the receiver.

Example: What will be the voltage drop in a circuit where 110 volts is to be impressed on the load and the allowable drop is 4 per cent of the voltage impressed on the circuit?

Substituting in the above formula,

$v = 4 \times 1.1 \times (1+0.04) = 4.4 \times 1.04 =$ 4.58 volts.

If one prefers not to make use of an algebraic formula, problems like the foregoing may be readily solved by remembering that the percentage which the delivered voltage is of the impressed voltage is to be found by subtracting the percentage loss of voltage from 100. For instance, in the problem just solved, 110 volts is obviously 96 per cent of the voltage impressed on the circuit, and the impressed voltage is thus seen to be 114.58.

It is necessary in designing circuits to apportion the total allowable drop properly between the components of the wiring system; that is, among the feeders, mains and branches. The table on page 501 indicates a good practice for lighting circuits at 110 volts.

In incandescent electric lighting most of the drop should be confined to the feeders, so that all of the lamps on mains and branches served by the same feeder will burn at about the same brilliancy. If most of the drop is in the mains and branches, lamps of the same candlepower rating located close together but served by different mains, may burn at decidedly different brilliancies. Figs. 2 and 3 illustrate drop distribution.

With motor circuits it is desirable to confine most of the drop to the mains, so that a variation in the load on one motor or group of motors will affect the speeds of the others as little as possible. If most of the drop is in the feeder, a heavy overload on one motor might cause a very appreciable reduction in the speed of all the motors served by this feeder. In general, on low-voltage motor circuits, one volt

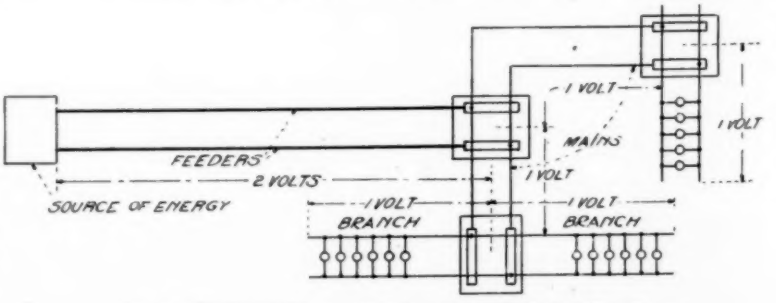


Fig. 2.—Distribution of Voltage Drop in Lighting Circuit.

loss can be allowed in the branches, two-thirds of the remainder of the total loss, in the mains, and one-third of the remaining allowance in the feeder. Fig. 4 shows the drop distribution for a system wherein the total allowable drop is 5 per cent.

Where a wiring system is not laid out in accordance with a feeder-and-main system, the drop must be apportioned among the conductors in accordance with the judgment of the designer, but the principles outlined above should be considered. If a motor circuit consists only of a main and branches (Fig. 6), one method is to allot one-volt drop to the branches and the balance of the permissible drop to the main. Where motor branches are not very long the drop in them is frequently not far from one volt. It may, with full-load current, in practice, be often assumed that it is one volt. Direct-current motor branches must be large enough to carry a current of 25 per cent greater than the full-load current, according to the regulations of the National Electrical Code.

As already suggested, current-carrying capacity should always be considered in the design of circuits. A wire may be large enough to carry a given current a given distance without undue drop, and yet be so small that the current will overheat it. After a conductor size has been selected with reference to drop, a table of safe current carrying capacities should be consulted. If the wire first selected is not large enough to carry the current safely, one that is large enough should be substituted for it. The matter of safe current-carrying capacity must be watched very closely in circuits that are short.

The resistance of a mil foot of commercial copper—that is, a wire one foot long and having an area of one circular mil—at a temperature of 75 degrees Fahrenheit, is usually given as from 10.6 to 10.8 ohms. For wiring calculations, 11 ohms is sufficiently accurate. It is useless to exercise refinement, especially since the purity of the copper is unknown and the circuit lengths are often not accurately measureable, and since the difference between the successive sizes of wire, that is, between the even numbers, is about 60 per cent; to say nothing of other indeterminate factors.

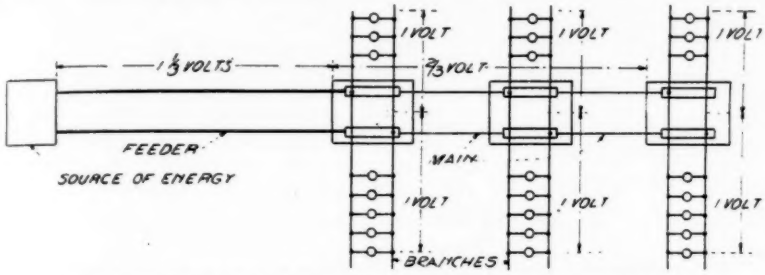


Fig. 3.——Distribution of Drop Where Maximum Drop is Three Volts.

DISTRIBUTION OF DROP IN 110-VOLT LIGHTING CIRCUITS.

Part of Circuit.	Proportion.	4 Volts Total Drop. Actual Drop.	4 Volts Total Drop. Per Cent Drop.	3 Volts Total Drop Actual Drop.	3 Volts Total Drop Per Cent Drop.
Branches	1 volt	1 volt	0.91	1 volt	0.91
Mains	0.33 of remainder	1 volt	0.91	0.66 volt	0.60
Feeders	0.66 of remainder	2 volts	1.82	1.33 volts	1.21
Total		4 volts	3.64	3 volts	2.72

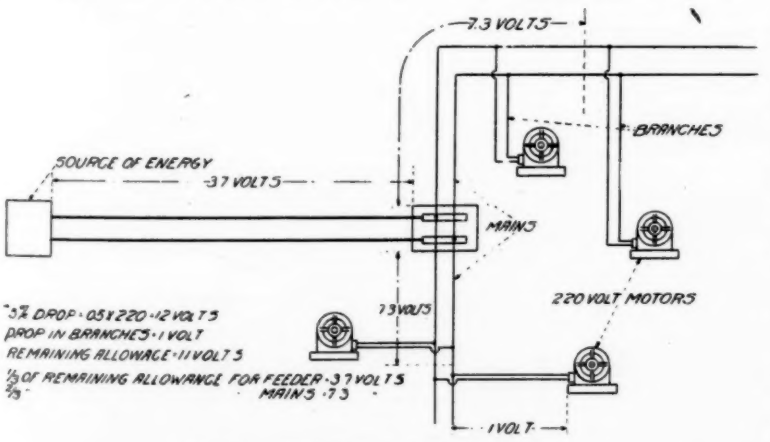


Fig. 4.——Voltage Loss in Motor Circuits.

Nearly every wiring problem involves the finding of the size wire that will carry a given current a given distance with a given drop in volts. The steps to be taken in finding the wire size in any such problem are as follows:

(1) Determine the load in amperes that will come on the circuit. This ampere load value will be used in taking the wire size from a table or will be substituted for the letter *I* in a formula.

(2) Find the distance to the load center of the circuit. This distance will be the actual length if the load is concentrated at the end, or it will be the distance to the load center if the load is distributed. It is the distance to the electrical center of gravity of the receivers on the circuit. The distance to the load center of a symmetrical group of receivers is indicated by the letter *L* in Fig. 8. The group of receivers in this case consists of six incandescent lamps each of equal imput and spaced equidistantly. Hence, the load center (Fig. 8) is at the center of the group.

Fig. 5.—Rotometer.

The method of determining the load center of an unsymmetrical group of receivers is illustrated in Fig. 10, wherein each of the rectangles connected between the two wires of the branch circuit is supposed to represent a receiver requiring the number of amperes indicated by the value within the rectangle. The distance to the load center (*L*, Fig. 10) is computed by multiplying the current in amperes taken by each receiver by its distance in feet from the starting point of the circuit, adding together the products obtained in the case of each receiver and then dividing this aggregate product by the total amperes taken by all of the receivers. The following numerical example worked out for Fig. 10 clearly illustrates the method.

Calculations:

100 amperes × 80 ft. = 8,000 ampere-ft.
40 amperes × 100 ft. = 4,000 ampere-ft.
20 amperes × 130 ft. = 2,600 ampere-ft.

8,000 + 4,000 + 2,600 = 14,600 ampere-feet.

100 + 40 + 20 = 160 = total load in amperes.

Then 14,600 ÷ 160 = 91 = distance in feet to load center.

In Fig. 9 is shown the meaning of length of circuit as applied to feeders and mains. As indicated, where no current is taken from a circuit except at the end the letter *L* in wiring formulas denotes the entire length of the circuit.

It should be noted that it is not often necessary in practical work to accurately compute the location of load center as suggested in Fig. 9. Sometimes it is necessary in complicated cases, but

TABLE II. SAFE CARRYING CAPACITIES OF COPPER WIRES.

	A. Rubber Insulation.	B. Other Insulations.	
B. & S. G.	Amperes.	Amperes.	Circular Mils.
18	3	5	1,624
16	6	8	2,583
14	12	16	4,107
12	17	23	6,530
10	24	32	10,380
8	33	46	16,510
6	46	65	26,250
5	54	77	33,100
4	65	92	41,740
3	76	110	52,630
2	90	131	66,370
1	107	156	83,690
0	127	185	105,500
00	150	220	133,100
000	177	262	167,800
0000	210	312	211,600
Circular Mils.			
200,000	200	300	
300,000	270	400	
400,000	330	500	
500,000	390	590	
600,000	450	680	
700,000	500	760	
800,000	550	840	
900,000	600	920	
1,000,000	650	1,000	
1,100,000	690	1,080	
1,200,000	730	1,150	
1,300,000	770	1,220	
1,400,000	810	1,290	
1,500,000	850	1,360	
1,600,000	890	1,430	
1,700,000	930	1,490	
1,800,000	970	1,550	
1,900,000	1,010	1,610	
2,000,000	1,050	1,670	

any man that is calculating many circuits soon is able to determine by inspection about where the load center of a circuit lies, and usually such approximate determination is sufficiently accurate, in view of the other unavoidable and indeterminate sources of error that affect wiring calculations. However, the principle involved should be fully understood.

(3) Decide what voltage drop is allowable. Preceding paragraphs indicate about what voltage drop is allowable in circuits of different classes. Table I indicates good practice as to distribution of drop in lighting circuits. Consider Fig. 9 and assume that a total drop of three volts is allowable in feeders, mains and branch. Then, referring to the table, "Distribution of Drop in 110-Volt Lighting Circuits," a drop of one volt should be allowed in branch circuits *C* and *D*, a drop of two-thirds of a volt in the main *B* and a drop of 1.33 volts in feeder *A*.

(4) Determine the wire size that will give the voltage drop decided on in (3) by using the formula that follows, using the values for distance and volts drop from (2) and (3). As an example of the application of the above suggestions, the conductor size for the two-wire, direct-current circuit of Fig. 10 will be computed. The effective length of the circuit, *L*. This can be taken as 91 feet with an error which is entirely negligible in wiring calculations. The load on the circuit is 160 amperes. Assume a total drop of 3 volts. Then substituting in the accepted formula:

Circular Mils = $22 \times L \times I \div E = 22 \times 91 \times 160 \div 3 = 106{,}770$.

For exactly 3 volts drop, with exactly the conditions indicated by the numerical values that were used in the formula above, a conductor of a cross-section of 106,770 circular mils would be used. However, since only conductors of commercial sizes can be used in practice, a No. 000 conductor (area, 167,800, see Table II) would be used. This is the next larger commercial size than that that the formula indicates should be used.

(5) Check the wire size determined in (4) to see that it is large enough to safely carry the current.

Solving the wire size for the circuit of Fig. 10, it was found that a No. 000 conductor should be used. Referring again to Table II, it will be noted that in A, for wires with rubber insulation, which really means for wires for concealed work, a No. 000 conductor may

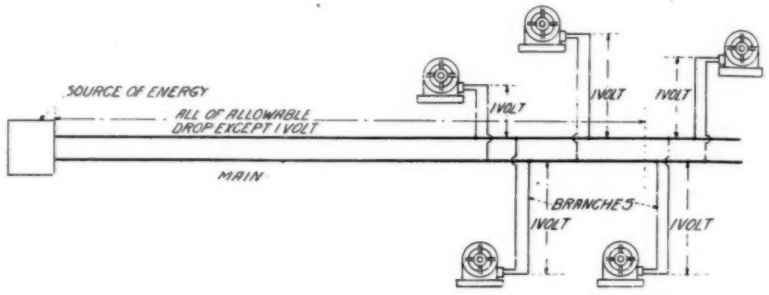


Fig. 6.—Distribution of Loss of Pressure Among Mains and Branches in Motor Circuits.

safely carry 177 amperes. In the table for wires with other insulations, meaning, in general, for open work, a No. 000 wire will safely carry 262 amperes. Since the load on the circuit of Fig. 10 is but 160 amperes, a No. 000 wire with either rubber or other insulations can safely be used.

Assume for illustration that the load on the circuit of Fig. 10 was 180 amperes. Then a No. 000 wire having an insulation other than rubber would safely carry the current, but if conditions were such that rubber-insulated wire had to be used, the next larger size rubber-insulated wire, No. 0000, would have to be applied.

(6) Where economy of operation is a factor, check the size of conductor as determined, to be sure that the cost of the energy wasted in it in overcoming its resistance will not be excessive. A discussion of this feature, though while it is not complicated, is

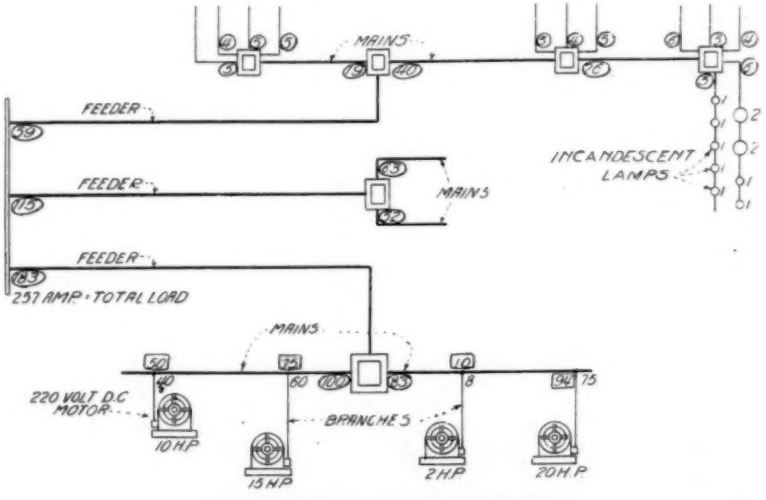


Fig. 7.—Method of Laying Out Circuits.

tedious, and would require more space than can be given here. A good common sense discussion of the matter is found in Chapter III, of Horstmann

and Tousley's "Electrical Wiring and Construction Tables."

It is seldom, if ever, necessary to consider the matter of conductor economy in connection with interior lighting circuits, because requirements of safe current-carrying capacity and small voltage drop usually render necessary

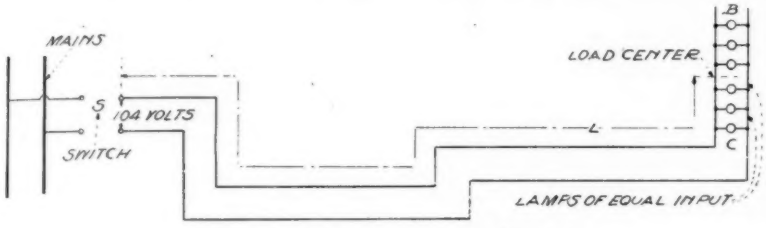


Fig. 8.—Load Center on a Lamp Circuit.

the installation of conductors larger than would be required if the wire sizes were based solely on conductor economy. In power wiring where the conductors are loaded for a considerable portion of every 24 hours, the matter of conductor economy is frequently one of considerable importance.

In determining circuit lengths from drawings or blue prints, a long piece of tough paper graduated on the same scale as the drawing can be effectively used in scaling distances. Always allow for rises or drops for wall outlets. The rotometer, Fig. 5, is also a convenient tool for scaling distances. The little wheel is run over the course of the circuit. The pointer indicates feet directly for drawings of certain scales. For other scales the dial reading must be multiplied by a constant to obtain actual lengths. A rotometer costs two or three dollars.

It is necessary to determine the load

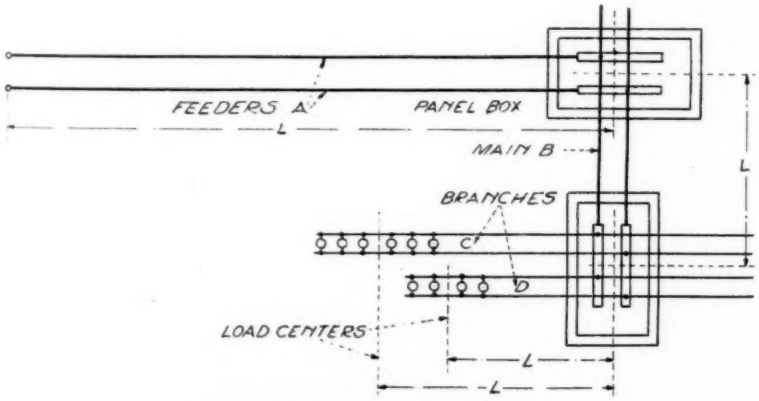


Fig. 9.—Load Centers on Branch Circuits.

in amperes that will come on each conductor in a wiring system for figuring the wire sizes, so that one may be sure that the wire will safely carry the current. Where drawings are available, note the ampere loads on the sheet in pencil as shown in Fig. 7. The figures opposite the receivers indicate the currents they take. The total load on each branch, main and feeder is indicated within a circle. Motor branch circuits must be large enough to safely carry 25 per cent more than full load current. It is convenient to note a current 25 per cent greater than full load-current in a square near each motor branch, as in Fig. 7, so that the wire for the branch can be checked for carrying capacity. Thus the 10-horsepower motor in the lower left-hand corner of the figure requires 40 amperes on full load, and the branch circuit must therefore be laid out for 50 amperes. Also, the 15-horsepower motor takes 60 amperes and must be wired for 75. The maximum total load on this main, under normal conditions, will be 100 amperes, a memorandum of which fact is made by inclosing the quanity 100 in a circle at the left of the cutout cabinet.

It is doubtless understood that in Fig. 7 a single straight line is employed to represent all the wires in a circuit, and not simply one leg of the circuit.

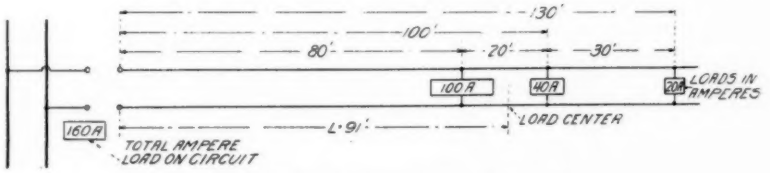


Fig. 10.—Method of Computing Load Center.

Annual Banquet of Electrical Department of Philadelphia Fire Underwriters' Association.

The Electrical Department of the Philadelphia Fire Underwriters' Association held its annual banquet on the evening of February 21, 1913. The spread was a Shore Dinner, and the entire affair was most successful.

The full corps of twenty-five inspectors was present, also the following guests: Washington Devereux, John H. Kenney and William McDevitt, the Philadelphia Fire Underwriters' Association; C. H. Hill, Fire Underwriters' Association of the Middle Department; Charles Carpenter, the Cutler-Hammer Manufacturing Company, New York; John Wansor, Brilliant Manufacturing Company, Philadelphia; E. B. Mallory, Economy Fuse Company, New York; D. B. Wilson, General Electric Company, Philadelphia; Gilbert Smith, J. F. Buchanan & Company, Philadelphia; President Brooks, Philadelphia Electrical Bureau; J. D. Israel, F. G. Moore, J. M. Elgin, P. H. Bartlett and William Kerford, Philadelphia Electric Company; President Williams, Philadelphia Electrical Contractors' Association; and Charles Fife, American Gas Fixture Works, Philadelphia.

A full string orchestra rendered many choice numbers and accompanied songs, choruses and solos. All present, as a peace offering at the home altar, carried away with them a two-pound box of Whitman's choicest sweets, and, from latest returns, the magic box worked its spell. All were welcomed to their respective abodes with smiles and no questions were asked.

A recent city ordinance in Newark, N. J., specifies that within certain portions of the city all electric wiring must be installed in rigid conduit, flexible steel conduit, or in armored cable. This territory comprises a large part of the city. All buildings used for schools, auditoriums, churches, places of amusement, garages, store rooms, warehouses, or for office buildings, and every public building, must be wired with conduit or armored cable regardless of whether the building be located within the territory referred to or not.

THE INCLOSED FUSE.

By Howard R. Sargent.

A casual examination of an inclosed fuse would seem to indicate that it is an extremely simple device, while, on the other hand, it has taken years of research work on the part of carefully trained engineers to bring it to its present state of perfection.

The National Electrical Code has been very wisely drawn, in that it demands that fuses shall be sufficiently dust-tight that lint and dust cannot collect around the fusible wire; in that it prescribes the time limits in which fuses must blow and the limits of temperature of the outside of the tubing; in that it demands that the fuse element shall be properly attached to the blade or ferrule; and in that it makes definite statement that inclosed fuses shall only be reloaded by the manufacturers originally making the same.

In order to meet the ratings prescribed, the fuse elements must have correct shapes and cross-sections, necessitating rolls which will finish them to one-half of 0.001 inch in thickness; carefully gauged dies are used to produce the proper shapes, and when the numerous ampere capacities in which these fuses are made are considered, one will readily comprehend the tremendous equipment in dies, punch presses, rolls, etc., necessary to manufacture these vital elements used in the make-up of these devices.

Fiber tubing is generally used for the casings for inclosed fuses, and, as is well known, fiber will carbonize provided it is subjected to excessive heat, or in other words, heat beyond the limits allowed by the National Electrical Code. Unless the fuse elements are prepared with great care and precision, excessive heat is sure to occur, with a probability of the weakening or destruction of the fiber tubing, which may result in serious conflagrations or explosions.

Inclosed fuses are frequently installed in localities in factory buildings where there is considerable vibration. It is absolutely essential that the fuse elements be properly riveted and soldered to the fuse blades, as vibration will soon loosen a screw in metal-to-metal construction, as would be the case if the fuse elements were screwed to the blades. If the screws should loosen up, the screws would be destroyed after a certain amount of arcing had taken place inside the fuse, and the fuse itself would probably be demolished.

The sizes of tubing for each rating of fuse as demanded by the Code have been arrived at by careful experimentation and a certain volume of filler for each size of fuse is necessary to absorb and dissipate the gases. If a fuse is carelessly reloaded, and copper wire, lead or an improper fuse element is installed, there is every probability that the fuse will burn up or explode, sooner or later, under operating conditions.

This is due in the case of a copper element, to the fact that its melting temperature is many times that of the material used in the manufacture of elements for standard inclosed fuses. In order to obtain any protection from a copper wire, as to blowing point, the wire itself must be run at a red heat, with the result that the tubing will soon char, and every time the fuse is cooled down, its cross-section and blowing point becomes less, due to the oxidized copper flaking off.

When a lead element is blown, the volume of gas given off due to the large cross-section necessary, is such that it is impossible to dissipate it fast enough under short-circuit conditions, with the result that an explosion is inevitable. An explosion in an inclosed fuse is a serious proposition. A number of years ago, before the inclosed fuse had reached its present state of perfection, a competitive inclosed fuse test on 400-ampere, 650-volt fuses was held in one of the substations of a large metropolitan railway company. The construction of one of the particular fuses submitted embodied heavy cast terminals. When the short-circuit was thrown on, the fuse exploded and threw one terminal a distance of 50 feet, passing it within a few inches of the head of one of the spectators, and imbedding it in the wall of the building. Such an explosion taking place in a sweat shop, or in fact, in almost any locality, would cause a panic, assuming that nobody was struck by the flying parts.

Another effect of too much fuse metal for the volume of the casing was strikingly illustrated during this same test, about three o'clock in the morning. Another fuse submitted by one of the manufacturers was tested, and, due to the fact that it contained too much fuse metal, the arc held for an instant, and the great cables back of the switchboard became unsoldered, dropping on to the gallery girders, producing a short-circuit which vey nearly resulted in a loss of life. The building was of such a construction that the only exit was directly beneath the switchboard, and the tremendous power back of the railway system was concentrated in this blinding arc directly above the entrance.

The building was filled with smoke and copper fumes; molten metal dropped like rain, lights went out, rotary converters were whirring on all sides, producing a condition which was extremely dangerous to the participants who were boxed in. As those present were rushing for the exit with coats wrapped over their heads, one of the spectators was observed and carried out, who, becoming panic-stricken, had climbed a ladder to one of the windows, and was trying to shake from their position, the 1¼-inch steel bars with which the windows were girded. It is safe to assume that all of the fuse manufacturers who were present at that meeting gained considerable experience with regard to the relation which exists between the dimensions of the fuse element and the total volume of the inclosed fuse.

The filler which surrounds the fuse element must be of a proper chemical composition to absorb and allow the dissipation of the gases, and to prevent chemical action without holding the fuse element so closely that its blowing point will be affected.

If the public at large were to reload inclosed fuses, and the proper filler were not at hand, the most natural material to use would be sand. If sand, or almost any one of the most easily obtained substitutes are used as a filler for an inclosed fuse, about one minute after the fuse has blown under normal conditions, these fillers become conductors, with a result that the inclosed fuse spurts flames in all directions, this terrible conflagration lasting for several minutes. Perhaps, if the proper filler is not at hand, it may be omitted entirely, under which condition, the gas is not absorbed and the fuse explodes.

A very careful design is necessary for the caps which go on the ends of the fiber tubes, so that they will allow the proper amounts of gas to escape and yet confine anything which could possibly cause a conflagration; and the whole fuse must be carefully assembled so as to obtain absolute alinement of the blades, as an excessive temperature at the terminals has a very considerable effect on the blowing point of the fuse.

Under the present ruling of the National Electrical Code, it is a misdemeanor for the proprietors of sweat shops, stores, small factories, apartment houses, etc., to reload inclosed fuses, and if a fire results from a fuse which has been surreptitiously reloaded by a consumer, the insurance, in all probability, is annulled. It must be confessed that occasionally inclosed fuses are secretly reloaded by consumers, but when we consider the tremendous number of inclosed fuses which are used, this abuse is practically negligible, very largely due to the great activity on the part of the Under-

writers' inspectors throughout the country.

Careful investigation among the consumers of inclosed fuses indicates that there are approximately 10 per cent renewals on an average per year, and when one considers that, if protection is needed, it is badly needed, the small expense of using properly constructed enclosed fuses amounts to almost nothing.

A number of years ago the Underwriters' Laboratories, together with engineers from the inclosed fuse manufacturers, standardized the overall dimensions of inclosed fuses and fuse blocks for the same, dividing the ratings into sections, each section consisting of a number of different ampere capacities having the same dimensions. This standardization resulted in great benefit to the manufacturer, the jobber, the contractor, and the consumer, in that the number of devices to be stocked is limited, and in that all of the fuses are interchangeable, fuses of some make being available to a consumer in case of immediate necessity.

A quick and satisfactory service to the consumer could not be given if the jobbers and contractors were obliged to carry the almost numberless different forms of ferrules, blades, fibre tubings and fuse elements, used by all of the different manufacturers, and the Underwriters' Laboratories and the National Fire Protection Association are to be congratulated on their action in not placing in the hands of the irresponsible public, the reloading of devices on which are dependent the safety of property, of eye-sight, of life and of limb.

Bill to License New Jersey Contractors.

There is a bill before the State Legislature of New Jersey, which, if it becomes a law, will make it necessary for electrical contractors and electricians carrying on business or working in the state, to hold state licenses. Under the terms of the bill, contractors are required to give bonds in the sum of $2,000.

It has been announced that the Chicago Asosciation of Electrical Contractors has agreed to defray the expenses of all members of the organization who wish to attend the next annual convention of the National Electrical Contractors' Association, which will be held in Chattanooga, Tenn., sometime in July of this year. An official of the local and the National associations has stated that it is planned to have an attendance at Chattanooga from Illinois much larger than the state has ever sent to a convention of the National organization before.

LETTER TO THE EDITOR.

Cutout Cabinets.

To the Editor:

Referring to the article in your issue of February 1 on "Cutout Cabinets," by R. H. Eddy, the writer wishes to point out that it is rather bad practice, especially for the lighting companies, to have the main switch and the branch plugs in the same cabinet as shown in the illustration, where a main will be going directly out of the boxes. This makes the theft of current exceedingly easy for anyone disposed to take current without paying for it. A. W. Lindgren.

Duluth, Minn., February 8, 1913.

Among the Contractors.

J. C. McDowell has been appointed electrical inspector for the city of Savannah, Ga. He assumed the duties of the position on March 1.

The Public Service Railway Company, of Jersey City, N. J., has awarded the contract for the electric wiring in its plant on Palisade Avenue to Louis Fort, of the city mentioned. The amount of the contract is $2,365.

The Adams Electric Company, of Trenton, N. J., has the contract for the electrical work on the new county jail in this city, the price being $2,888.

R. C. Bierdemann, of Chicago, has begun the wiring of a building on North Ashland Avenue for 560 lamps and one motor.

The electrical work in the Merchants' Cold Storage building, Chicago, has been awarded to Freeman, Sweet & Company, of this city.

The city council of Portland, Ore., has awarded the contract for the installation of a number of four-candlepower lamps on the Broad Bridge in Portland to the West Coast Engineering Company.

The Evans-Dickson Company, 725 Commerce Street, Tacoma, Wash., has the contract for the electrical work on the annex to the National Realty Building in that city.

A. W. Delbridge, who has been connected with the Lewis Electric Company, at Grand Rapids, Mich., for several years, will soon go into business for himself as an electrical contractor. The concern at the head of which he will be will be known as the Madison Square Electric Company, and its headquarters will be 1221 Madison Avenue, Grand Rapids. The company will do and electrical contracting business and carry a stock of supplies.

George W. Walther, of Baltimore, Md., has been awarded the contract for the electric light wiring in the new telephone exchange building of the Chesapeake & Potomac Telephone Company, in Baltimore. Galvaduct will be used throughout the job.

Davis & Hull, a prominent firm of electrical contractors and engineers, of Tacoma, Wash., has recently been awarded the contract for the installation of the electrical equipment on the Puyallup River lift bridge, in that city.

Peters & McKinney, of Atlanta, has been awarded the contract for the electrical work in the new 17-story Healy office building. The contract price is approximately $20,000 and work will start within 60 days.

J. J. Ziegler Company, Limited, electrical contractor of New Orleans, La., did the electrical decorative work for the Elks' Carnival ball.

E. D. Fuchs & Company, of Chicago, has just taken the contract to do the wiring in two large buildings in this city, one of which is to be wired for 1,000 incandescent lamps and the other for 500.

L. K. Comstock & Company, of Chicago, has begun the installation of the electrical work in the new Continental & Commercial National Bank Building in this city. The contract on this building calls for a million feet of Sherarduct conduit. The National Metal Molding Company, the manufacturer of Sherarduct, has commenced the delivery of this large order for conduit, the order having been handled by the I. A. Bennett Company, of Chicago, western agent of the manufacturer mentioned.

March 19 has been set as the date of the annual banquet of the Louisville Electrical Contractors' Association. Just where the electrical experts will regale the inner man has not yet been determined, but the date is set, and, in the light of experience with past banquets, it is thought that the craftsmen are already doing a little fasting on the side in order to be fit as a fiddle for the delectable menu which will surely be forthcoming. Frank Good, president of the Association, has appointed a committee of three connoisseurs—Gus Albrecht, H. G. Bland and A. J. Anderson—to attend to the details of this gastronomic event.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Adapting the Lamps to the Voltage.

A few days ago I was called upon to wire a group of five 30-volt lamps on a 118-volt circuit. The lamps were to be used in a machine room, and there was no objection to an arrangement whereby only four of them could be burned at one time. I connected the lamps as shown in Fig. 1.

In the figure *S* is a double-pole, double-throw switch, the two contacts at *A*, and also the two at *B*, being connected together electrically. When the switch is thrown down lamp *D* is cut out of circuit and lamps *E* and *F* burn. By throwing *S* into the upper contacts lamp *F* is shunted and the others left burning.

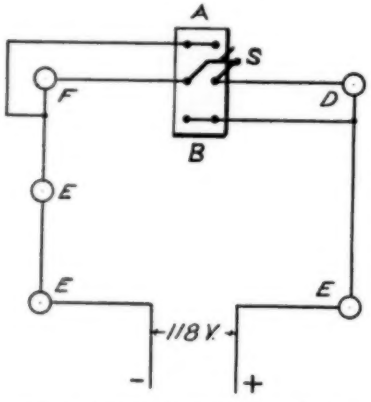


Fig. 1.—Method of Connecting Lamps.

William Lepper.

Making the Fixture Hang Vertical.

The wiring kink which appeared under the above heading in the issue of February 8 seems to me to be practical in so far as it relates to the conditions specified. But I would suggest that trouble along this line can be avoided very often by testing the direction of the fixture stud at the time the outlet box is installed. In the case of straight electric boxes, this testing may be readily done by attaching a piece of iron pipe three feet or so in length to the fixture stud, by means of a coupling, and noting whether it points vertically downward or not. The pipe should be straight, of course, and should be threaded straight. Where it is desired to make sure that the stud points exactly vertically downward a spirit level may be used to test the direction of the pipe.

I find it convenient to use small iron washers in adjusting the stud to hang true. By placing these between the outlet box and the supporting board, the stud can easily be made plumb.

William A. Murray.

A Useful Type of Fixture Wrench.

A handy wrench for fixture work may be made by cutting an alligator wrench into two pieces and re-assembling in the manner shown in Figs. 2 and 3. The wrench is cut along the line shown in Fig. 2, and drilled for a three-eighths-inch stove bolt, which should be about two inches long. The two pieces are then assembled in the manner indicated in Fig. 3, the two ends being thus offset by nearly two inches.

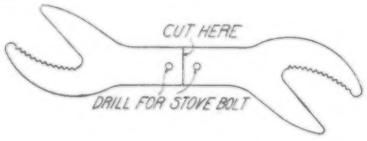


Fig. 2.—Wrench Ready to be Cut.

When installing fixtures on a ceiling with a tool like this, the mechanic can get a better grip on the wrench than if an ordinary wrench were used, and he has a good chance to keep his knuckles away from the ceiling and getting it soiled.

M. J. Moriarity.

Another Way to Make a Drill.

A good drill for making holes in brick or cement floors and walls may be made by taking a piece of hexagonal steel about a foot long, and, after heating one end of it, flattening the heated end until it is about an eighth of an inch thick and half an inch wider than the length of the diameter of the rod. Then the flattened end should be ground to a diamond point and the point carefully tempered.

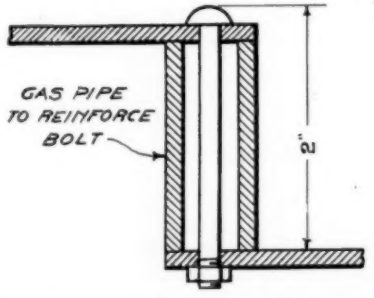


Fig. 3.—Enlarged View of Offset in Wrench.

When drilling in cement floors it is best to keep pouring water in the hole, as this will prevent the drill from sticking, while for keeping the water from splashing out of the hole, a leather washer may be slipped over the drill and kept there during the drilling.

Glenn Metcalff.

Hanging Fixtures on High Ceilings.

In a wiring kink published in the issue of February 8, C. W. Higinbotham mentions a method of avoiding the use of expensive scaffolding in installing lighting fixtures on high ceilings. My way of doing this is as follows.

I take a 26-foot extension ladder and convert it into a step-ladder by means of a rack or frame made of 1.25-inch rigid conduit. The frame is shown in Fig. 4. Two 10-foot lengths of conduit are used in each leg and the horizontal cross-piece is 20 inches long, with an ell on either end for connecting to the vertical legs, of course. When the frame has been assembled and the cross-piece strapped to the top round of the ladder by means of a strong trunk strap, the ladder is ready for use.

It is a good plan to tack cleats to the floor at the bottom of each vertical pipe to keep these from slipping while in use.

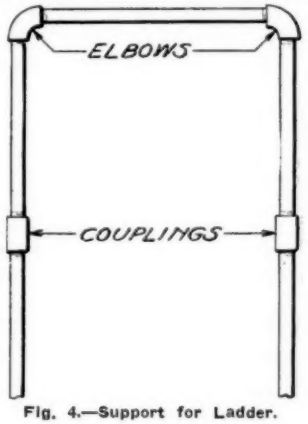


Fig. 4.—Support for Ladder.

I have made use of a ladder like this in hanging fixtures in churches and public halls where the ceilings were from 20 to 25 feet high. Thus I avoided the necessity of erecting expensive staging, and at the same time secured an arrangement which made it easy to fit the fixture canopies snugly on the ceiling, which, it seems to me, might be rather difficult with the method mentioned by Mr. Higinbotham.

J. Warren Ramsey.

State Association of Contractors and Inspectors Proposed.

At a recent meeting of the Electrical Contractors' Association, of Seattle, Wash., the formation of a state association to promote a better understanding and closer co-operation between contractors and the city inspection bureaus was discussed.

Public Service Commissions

WISCONSIN.

The engineering staff of the Railroad Commission of Wisconsin has reported the results of an investigation made upon the street-lighting situation in the city of Milwaukee. The investigation, which was carried out at the request of the city officials, included a study of such subjects as the rights and privileges of the city and the lighting companies under the public-utilities law; the suitability, efficiency and cost to the city of the present lighting systems; the results to be expected from an adequate street-lighting system; changes which would improve the illuminating value of the present systems; the most economical method of operation. The report included a series of recommendations made the city of Milwaukee.

According to the provisions of a water-power bill recently introduced in the legislature, the construction, maintenance, and operation of dams on all the navigable rivers of the state for the purpose of improving navigation or the development of hydraulic power, is to be under the supervision of the Railroad Commission. Dams may be constructed and maintained only under franchises to be granted by the Commission upon petition and after a formal hearing and investigation has been made. All plans and specifications are to be passed upon and approved before construction can be commenced. The bill provides further that the Commission shall have control over the level and flow of water in all navigable waters of the state. The makers of the present bill have attempted to avoid these provisions of the bill passed by the legislature two years ago and which were declared unconstitutional by the Supreme Court.

In order to permit the Oconomowoc River Company to acquire the property of the Oconomowoc Realty Company, now furnishing power to the city of Oconomowoc and vicinity, the Commission has authorized the issue of $15,000 of stock and $7,000 of 6-per-cent bonds.

Upon complaint of the Water and Light Commission of the city of Columbus that the present rates for electric lighting and power were not satisfactory, the Commission has made an analysis of the question and has ordered the present rates discontinued. The rates, as ordered, are as follows: Primary rate, ten cents net per kilowatt-hour for the first 30 hours' use per month of the active connected load; secondary rate, eight cents net for the next 60 hours' use per month; excess rate, six cents net. Three classes of consumers are provided for; namely, Class A, consisting of residences, in which 60 per cent of the connected load up to 500 watts and 33.33 per cent of the excess is to be active; Class B, consisting of stores, offices, etc., in which 70 per cent is to be active; and Class C, consisting of churches, industrial establishments, hotels, schools, etc., in which 55 per cent is to be active. The power schedule consists of a capacity charge of 25 cents per month for each horsepower connected and a current charge of five cents per kilowatt-hour. For series-tungsten street lighting, a capacity charge of $3.50 per 100-watt lamp per year is to be made and a current charge of 4.5 cents per kilowatt-hour for current used.

OHIO.

The Brookville & Lewisburg Lighting Company, of Lewisburg, O., has been authorized by the Public Service Commission to issue capital stock of the par value of $10,000 to be sold for not less than par, proceeds to be devoted to the construction of a transmission line in Brookville.

The Hamilton Utilities Company has been authorized to issue capital stock of the par value of $255,000 to be turned over to the trustees for payment of the real estate, buildings, plant, lines, etc., of the gas and electric utility in the city of Hamilton. The Commission has formally approved the sale of the property by the trustees, William E. Hutton, F. L. Perin and Joseph C. Thoms to the Hamilton Utilities Company.

The Cleveland Railway Company has been authorized to issue its common capital stock of the par value of $3,600,000 to be sold for not less than par. The proceeds are to be used for the retirement of bonds and for new construction.

CALIFORNIA.

An order has been issued by the Railroad Commission granting the Southern Sierras Power Company permission to raise its schedule of rates for electric power service for pumping for irrigation purposes in certain portions of Riverside and San Bernardino Counties, outside of incorporated cities and towns.

Upon request of the applicant, the Commission dismissed the application of the Little Rock Power & Water Company for authority to issue bonds.

The Pacific Telephone & Telegraph Company was given authority to purchase the San Gabriel Valley Home Telephone Company.

A decision was rendered authorizing the Half Moon Bay Light & Power Company to accept promissory notes in payment for part of its capital stock, on condition that the stock should not be issued until the notes had been paid.

The Railroad Commission of California rendered a decision denying without prejudice the application of the Arrowhead Reservoir & Power Company to issue $4,000,000 of bonds. Suits were pending against the company in the Superior Court of San Bernardino County and in the United States Circuit Court at Los Angeles, and the Commission held that it would be improper to authorize an issue of bonds on property in controversy.

A decision was rendered granting the application of the San Diego Consolidated Gas & Electric Company to issue $204,000 of bonds.

The San Diego Gas & Electric Company was granted authority to exchange lands with the Park-Grable Investment Company, in La Mesa, San Diego County.

A decision was rendered granting the application of the San Francisco-Oakland Terminal Railways for a certificate of public convenience and necessity to exercise franchise rights to operate a street railroad along Standard Avenue and on a private right of way in Richmond.

The Railroad Commission rendered a decision denying the application of the Saratoga Telephone Company to increase its rates, and directed that the Pacific Telephone & Telegraph Company proceed to render service in and about Saratoga at the rates on file with the Commission.

A decision was rendered granting the application of the Long Beach Con-

solidated Gas Company for a certificate of public convenience and necessity to exercise franchise rights previously granted by the Board of Supervisors of Los Angeles County.

The Commission also rendered a decision authorizing the transfer to the Long Beach Consolidated Gas Company of a franchise previously granted by the county of Los Angeles to Geo. H. Bixby.

A decision was rendered dismissing without prejudice the application of the Mountain Power Company for a certificate of public convenience and necessity to construct and operate an electric plant in Del Norte County. The application was dismissed upon request of the applicant.

The Imperial Valley Gas Company was given authority to proceed to issue $154,500 in bonds. In the original order the bonds were made dependent upon a pending franchise application, which has since been granted.

The City Electric Company, of San Francisco, applied for authority to sell $833,000 of bonds which it had been previously authorized to pledge as collateral security.

A decision was rendered granting authority to the Vallejo & Northern Railroad Company to sell all its property to the Northern Electric Railway Company in exchange for $1,000,000 of Northern Electric Railway bonds. The Vallejo & Northern receives as additional compensation, $2,000,000 of the capital stock of the Northern Electric Railway Company.

The Pacific Telephone & Telegraph Company applied for a rehearing upon the case involving physical connection with the Tehama County Telephone Company and the Glenn County Telephone Company.

NEW YORK.

The Public Service Commission for the First District has called a public hearing, to be held March 15, on the terms of a proposed certificate to be issued to the Interborough Rapid Transit Company, granting the rights to construct and operate third tracks on the Second, Third and Ninth Avenue elevated railroads in Manhattan and The Bronx. The provision of these third tracks is a part of the plan underlying the dual system of rapid transit, for which the City is preparing to enter into contracts with the Interborough Rapid Transit Company and the New York Municipal Railway Corporation (Brooklyn Rapid Transit). The Commission originally prepared a certificate conveying such rights to the Manhattan Railway Company, which is the owner of the elevated railroads which are operated under a 999 year lease by the Interborough Company. Recently the Manhattan Company objected to the terms of the certificate and refused to accept it. Thereupon the Commission determined to make out the certificate to the lessee, namely, the Interborough Company, and did so. Before this certificate can be adopted, however, the law requires that a public hearing shall be held, and this public hearing will be held on March 15.

The Public Service Commission, Second District, has authorized the Chatham Electric Light and Power Company to exercise franchises for the furnishing of electricity in the towns of Ghent and Claverack and village of Philmont, Columbia County. The application was supported by the Board of Trustees of the village of Philmont.

The application of the Philmont Lighting Company for approval of franchises previously granted by the village of Philmont and town of Claverack, was denied.

Among the Supply Men

The Johnson Electric Supply Company, Cincinnati, O., has taken over the Johnson-Kennedy Electric Company, and moved to new and larger quarters at 232 and 234 East Fifth Street. The company will do a general electrical supply jobbing business, and will act as agents for the Adams-Bagnall Electric Company, Colonial Electric Works, of the General Electric Company, Colonial Fan & Motor Company and Pacific Electric Heating Company.

Pettingell-Andrews Company, Boston, Mass., made the February issue of its monthly organ, *Juice*, a special architects' number. It contained a number of articles calling attention to the company's excellent facilities, through its illuminating, engineering and fixture designing departments, for turning out original fixtures particularly adapted to exacting requirements. A number of fine illustrations bear out this statement.

The Pacific States Electric Company, successor to the Holabird Electric Company, Seattle, Wash., recently suffered a fire loss of stock and fixtures estimated at approximately $50,000, covered by insurance. The damage was caused by water from a fire in an adjoining building.

The Illinois Electric Company, Chicago, has secured the agencies in the Central States for Adams-Bagnall transformers and Bell single-phase motors. A complete stock of these lines will be carried in Chicago. The company held a very successful sales conference the week of February 3-8. There were some 50 in attendance including city and outside salesmen and representatives of manufacturers. Sessions were held morning and afternoon, when addresses were made by prominent manufacturers. In the evenings executive sessions of the company's selling organizations were held. Good reports were made from all over the field, and the outlook is promising.

A. M. Little, manager of the Mohawk Electrical Supply Company, Syracuse, N. Y., has been elected vice-president and manager and made a member of the board of directors. The company held a successful sales meeting on February 21 and 22. Business is exceptionally good for this time of the year, the orders coming principally from trade outside of the contractors' field. The company is making a drive on Shurlok sockets, made by Pass & Seymour, Incorporated. These are very popular among industrial plants and installations of a similar nature.

The Central Telephone and Electric Company, St. Louis, Mo., reports that it is pushing the sale of eight-inch oscillator fans, turbine table fans and Ajax hair and shoe dryers, and so far has met with splendid results. The company recently closed its Dallas, (Tex.) office, and is now soliciting business from its entire Texas territory, Gus Sachs having charge of this branch of the business.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 123.—Scrap Value of Tungsten Lamps.—I understand that tungsten is an expensive metal and therefore wish to find out whether burned-out or broken-filament tungsten lamps have any scrap value. What firms, if any, buy them? Can they be refilled like carbon-filament lamps?—T. N. S., Sandusky, O.

No. 127.—Deterioration of Conduit in Concrete.—After conduit has been in concrete for a few weeks I have found that it becomes very brittle at the point where it leaves the concrete. I would like to know whether any of your readers has had the same experience in a concrete building.—C. F. C., Albany, Ore.

No. 128.—Tungsten Lamps on Combination Trolley Poles.—Have any tests been made, or records kept, of the comparative life of drawn-wire tungsten lamps when mounted in clusters on independent ornamental posts and when mounted in clusters on combination trolley and light poles? Is it customary to use shock absorbers when using combinational poles?—P. T. N., Charlotte, N. C.

No. 129.—Electric Headlight and Generator for Bicycles.—I have been told there is a device called "Dynolite," believed to be made in England, that is a small dynamo that can be attached to a bicycle so it is driven by the front wheel and supplies current to a headlight with reflector that throws a powerful light onto the road ahead of the rider. I would like to get a good description of this device and the manufacturer's name and address.—J. E. T., Syracuse, N. Y.

No. 130.—Emergency Loan of Motors.—In the case of a shop driven by a single motor from a central-station supply line, is it the common practice of the power company to loan a spare motor temporarily, if the motor in the shop has broken down or needs repairs that would otherwise require shutting down the shop for three or four days? If this is done, what is the basis of charging for this service.?—W. M. K., Kankakee, Ill.

No. 131.—Setting Cedar Poles in Concrete.—Is it desirable to set cedar poles in concrete instead of directly in ground without protection? I am told that the concrete setting is so rigid that when violent storms occur the pole is liable to be broken off sharply right above the concrete around the base. Is this a common occurrence?—L. R. E., Davenport, Iowa.

No. 132.—Transformer for Foundry.—A new foundry with about 200 horsepower total connected load in motors is to be supplied from a 2,300-volt line. The average load and the load-factor are unknown and it is impossible to predict the future growth of the foundry's business, as there is considerable competition; the men in the new firm are experienced foundrymen, however. What is the best size of transformer to use for this installation? Would it be well to anticipate future increase of load or to provide for the immediate needs only?—B. F., St. Louis, Mo.

Answers.

No. 119.—Mechanical Rectifiers.—What is the efficiency of vibrating and similar mechanical rectifiers compared with that of mercury-arc rectifiers? What is the highest current that can be rectified by them without destructive sparking? Can they be used on circuits higher than 110 volts?—J. B. D., Springfield, Mo.

There is no comparison between the mechanical, vibrating rectifier, and the mercury-arc rectifier. They are intended for different classes of service. The efficiency of a mechanical rectifier is from 35 to 50 per cent, depending on the size. With a 5-ampere 6-volt rectifier the cost of charging a 6-volt 80 to 100-ampere-hour battery is from six to eight cents, by actual tests. Mechanical vibrating rectifiers can be purchased for 110-volt, 220-volt, 25, 50, or 60-cycle circuits, and their superiority over liquid rectifiers and mercury-arc rectifiers in point of portability, reliability, compactness, and low cost of operation, certainly justifies their widespread use for charging small lighting and ignition batteries. The efficiency of the mercury-arc rectifier is from 69 to 78 per cent. It operates at a higher voltage than necessary for charging small batteries and, unless a large number of batteries are available at the same time for charging, the most of the power used is sacrificed in resistance losses. Thus the cost of charging in this manner is excessive.—E. M. W., Chicago, Ill.

No. 124.—Vehicle-Battery Charging.—What is the most reliable device to cut off the charge on an electric vehicle battery automatically when the battery is fully charged?—S. B. F., Fort Wayne, Ind.

The most reliable device for cutting off a charge on electric automobile batteries when the battery is fully charged is an ampere-hour meter, operated in connection with a shnnt-trip circuit-breaker, Ampere-hour meters are usually set correct on discharge and 15 per cent slow on charge, in order to allow for the inefficiency of the battery. The Sangamo ampere-hour meter is a very reliable instrument, is very accurate, and stands a great amount of vibration, knocking about and abuse. Most types are equipped with an auxiliary contact at zero (representing full charge of the battery) by means of which current may be put around the tripping coil of a sunt-trip circuit-breaker, directly in the battery charging line. When the circuit-breaker trips, it breaks the current in the tripping coil so that this coil will not heat due to continued excitation. The ampere-hour meter may be used on any kind of a battery, either lead or Edison, and may be placed on the automobile, and is perfectly correct whether the battery is charged from direct current or from a rectifier connected to an alternating-current source of current. Another very reliable type of automatic cutoff is an automatic rectifier, the voltmeter of which has an auxiliary pointer which is set by means of a screw-driver to the proper battery cutoff voltage. When the voltmeter needle proper is coincident with the auxiliary needle, a platinum contact is made between the two needles, which recalibrates the voltmeter high so that the voltmeter needle proper remains coincident with auxiliary needle, and this contact puts current through the winding of an automatic cutoff relay which cuts the alternating current off the line. This is a great improvement over all other styles of rectifiers depending upon the going out of the arc in the bulb for the cutoff feature. While other rectifiers are often called automatic by uninformed salesmen, they are not automatic in any sense of the word. There is a new automatic rectifier on the market which, in addition to the features outlined above, has an overcharge time-switch device. When the voltmeter needle gets coincident with the auxiliary needle, the time switch comes into operation and will allow the battery to overcharge anywhere from four minutes to four hours, and then cut off by a clockwork arrangement, according to the length of time for which the overcharge device is set.—R. L. L., Minneapolis, Minn.

In the experience of the writer, the most reliable device for this service where lead cells are to be charged is the maximum-voltage automatic cutout operating in conjunction with a double-pole shunt-trip circuit-breaker, one leg alternating current and one leg direct current. The maximum-voltage automatic cutout is a relay which operates at any voltage for which it is set. In its operation it closes the connection through the shunt trip circuit of the double-pole breaker. A reverse-current relay is generally used for the protection of the charging apparatus against failure of the alternating-current source of supply. The reverse-current relay operates in parallel with the maximum-voltage automatic cut-

out. Either one of the relays operating causes the electric car to be separated from the charging outfit and the charging outfit separated from the line. The ampere-hour meter furnished with auxiliary contacts and operating in conjunction with a double-pole shunt-trip circuit-breaker is another means of cutting off the battery when fully charged.—E. M. W., Chicago, Ill.

No. 125.—Electric Thawing of Frozen Galvanized Pipe.—We have been doing quite a little pipe thawing, using our secondary circuits and getting excellent results. We have not found to date a pipe that we could not thaw out. One of our customers claimed, however, that thawing out a galvanized pipe by electricity had the effect of deteriorating the galvanizing and hence shortening the life of the pipe. Can some of your readers throw light on this point?—A. E. A., Laramie, Wyo.

If you are using alternating current for thawing there could be no electrolysis except under unusual conditions. If you are using direct current the zinc would not be removed from the exterior of the pipe unless the pipe were in water and the joints in the pipe of high enough resistance to make the current leave the pipe. Inside, in case of decomposition of the water after the heat of the pipe had melted the ice enough to make the water of low enough resistance to afford a better path than through the pipe, there might be a slight tendency for the zinc to be taken from one end of the pipe and deposited in another portion, but the resistance of even salt water is high compared to that of iron. I do not believe that thawing electrically is harmful as your customer seems to think. Heat applied in this manner is certainly not as harmful to the pipe as heating it by direct contact of a flame, such as a fire or gasoline torch.—H. E. W., Chicago, Ill.

There is absolutely no electrical effect on the galvanizing of any water pipe, providing that alternating current is used for the thawing process. The writer has thawed a good many miles of galvanized water pipes with no electrical effect to the galvanizing. If, however, direct current is used for the thawing of water pipes, the galvanizing may be carried from the pipe where the current leaves it, if the ground is used as any part of the conductor. If a complete metallic circuit is made, I can see no way in which galvanizing can be effected by using direct current in thawing of water pipes.—R. L. L., Minneapolis, Minn.

No. 126.—Automatic-Reset Annunciator.—How can an automatic-reset annunciator be made to reset itself when receiving its current from a bell transformer? I have had several which would not reset regardless of adjustment, but in all cases the bell would ring.—J. L. H., Rock Island, Ill.

Most bells for annunciator systems are wound with comparatively few turns of wire, usually not over 200 to 1,000 turns, and therefore do not offer enough reactance to prevent them from working on alternating or pulsating current. The annunciator drops, on the other hand, are made very sensitive and the largest possible pull must be exerted by the magnet, which is of necessity small on account of the space allowed. To make it work then a very large number of turns are required and these extra turns make the reactance so high as to prevent enough current flowing with alternating-current supply to operate them. Your case can be solved by using a coil with fewer turns or dividing the present winding in half and connecting the halves in parallel. If the wiring will stand it you might increase the voltage of the annunciator system. The Western Electric Company and other manufacturers make such systems to operate on alternating current of any voltage or frequency.—H. E. Weightman, Chicago, Ill.

Boston Motor Car Club Meeting.

The Boston Motor Car Club met at the Lombardy Inn, Boston, February 27, for its regular dinner and meeting. In the absence of President Day Baker, Vice-President E. S. Mansfield presided. O. G. Draper, who has been engaged as business secretary of the Club, called attention to the booklets which have been printed and distributed to members, and which contain the Constitution and By-laws, together with a list of officers, committees and members.

The Membership Committee reported the application of three for Class A membership and four for Class C, and these applications were accepted. The new members in Class A are E. A. Gilmore, of the Whitten-Gilmore Company; R. C. Gregg, of the Philadelphia Storage Battery Company; C. A. Perry, of the D. C. Tiffany Company; while the new Class C members are local newspaper men. The membership now stands at over 100, with several applications pending.

The Publicity Committee recommended that the business secretary prepare a booklet for distribution at the Automobile Show, soon to be held in Boston, and also buttons carrying some appropriate wording, calling attention to low-priced current for electric-car propulsion.

Converse D. Marsh advocated a method of advertising which shall not "knock" the gasoline cars, and suggested that the buttons carry the motto: "Price of Electricity Declining in New England." Mr. Marsh stated in this connection that the rate for electricity for charging is now lower than in any other large city in the United States, the price being three cents per kilowatt-hour.

O. G. Draper, business secretary, urged co-operative advertising. Let the aim be to promote all cars, with the claim, "Every electric car is a good car, but mine is the best." He said he hoped the Club would attract many new Class B members (users of cars), who will prove by their enthusiasm for the electric to be unpaid salesman in the industry. Mr. Draper, who is just now entering upon his duties for the Club, and is replete with ideas and plans for the promotion of its activities, said he held himself at the service of every member. His headquarters are at the Edison Building, 39 Boylston Street, where his office hours will be from 8:30 to 10 a. m., and 4 to 5 p. m.

Converse D. Marsh told of the unfortunate results in another city, of agents and salesmen criticising other makes of cars than their own, with the result that would-be purchasers of electric automobiles have been discouraged from purchasing any car of the type. Mr. Marsh commented on the greater percentage of advance in sales in Boston than in any other city, particularly since the formation of the Club to promote the business.

Mr. Draper outlined a plan of advertising similar to one in vogue in Philadelphia, by which local dealers pool their interests and place large, conspicuous advertisements in the daily newspapers each week. Since the pleasure car appeals strongly to women, it is suggested to put advertisements pertaining to this branch of the business on the society page, while the truck, appealing chiefly to the business man, should be advertised on or opposite the financial page. Plans for future meetings include speakers on practical topics of interest especially to users of cars.

A change in the Constitution was proposed, by which the duties of the business secretary are to be defined and his work placed under the direction of the Executive Committee. The duties of the secretary—to be known in distinction from the business secretary—are also defined. The method of providing for the salary of the business secretary is by the underwriting of shares of $25 each for the year, by members who are agents, or manufacturers or dealers in acccessories.

Placards setting forth the advantages of membership in the Club are to be issued and posted in garages. Talks on the ease with which a woman can care for her own automobile, will be a feature of a future meeting. The Club is active in securing uniform rates for charging in certain sections or zones of New England, and when this plan is perfected, pamphlets will be issued showing these zones and rates.

American Institute of Electrical Engineers.

Midwinter Convention in New York City, February 26, 27 and 28.

The American Institute of Electrical Engineers held a midwinter convention at the Engineering Societies Building in New York City on February 26, 27 and 28. This was a unique departure from the usual practice of the Institute and was undertaken for the purpose of gathering material together which might be of assistance in the proposed revision of the Standardization Rules. The convention was held under the auspices of the Standards Committee. The total registration was 421.

The convention was called to order by President Ralph D. Mershon on Wednesday at 10:30 a. m. After opening the meeting, the chair was turned over to Arthur E. Kennelly, chairman of the Standards Committee, who presided over the reading of papers and the technical discussions. Among those occupying seats upon the platform was Leo Schüler, delegate from the Verband Deutscher Elektrotechniker. Professor Kennelly made some introductory remarks referring to the need for revision, the various aspects of the Rules and the interests which they affect, and the desire for simplicity and comprehensivenes in their construction. He also referred to their international aspect in view of the work of the International Electrotechnical Commission, upon which the American Institute has representation, in attempting to coordinate practice and usage in various countries.

The papers presented at the convention were grouped according to subject matter into four groups, the first dealing with heating, heat measurements and rating by heat; the second with methods of determining losses in apparatus; the third with methods of testing apparatus for performance, and the fourth with miscellaneous subjects. In the case of each group the entire list of papers was first presented in abstract and they were discussed in sub-groups. There were also presented two committee reports by subcommittees of the Standards Committee. The first of these was by C. P. Steinmetz and B. G. Lamme, and was entitled "Temperature and Electrical Insulation." The second report was by W. L. Merrill, W. H. Powell and Charles Robbins, and was entitled "Method of Rating Electrical Apparatus." These two reports were presented at the first session.

Temperature and Electrical Insulation.

The problem of permissible temperatures in electric apparatus is largely that of the durability of the insulation used. As this may consist of materials of widely varying heat-resisting qualities, the problem resolves itself into one of consideration of the properties of the materials themselves. The durability of insulation may be considered from two standpoints, the mechanical and the electrical. Tests and experience have shown that temperatures which may ruin the insulation, from a mechanical standpoint, may not radically affect its electrical strength. This is particularly true with moderate voltages where the insulation serves largely as a separating medium. Insulations may be classified under three headings, depending upon their heat-resisting properties: class A includes most of the fibrous materials, as paper, cotton, etc., most of the natural oils, resins and gums, etc.; class B includes what may be designated as heat-resisting materials, which consist of mica, asbestos, or equivalent refractory materials, frequently used in combination with other supporting or binding materials; class C is represented by fireproof materials, such as mica, so assembled that very high temperatures do not produce rapid deterioration. Further discussion of this subject is along the line of the address of Mr. Lamme given on page 245 of the issue of February 1. Measurement of temperature by thermometer and resistance, the two conventional methods, is discussed. The resistance method gives the average internal temperature of windings and not that of local hot spots. Where resistance cannot be measured during the operation it should be done as quickly as possible after shutdown. With thermometers, temperature should be taken during operation and the thermometer and pad placed so as not to interfere with air circulation. The temperature gradient through the insulation should be allowed for, this often representing a temperature 10 to 15 degrees higher inside. Blind adherence to some particular method of taking temperature may lead to fallacious results. The committee recommends that: with class A insulation, 90 degrees centigrade be taken as the ultimate temperature limit, corresponding to 50 degrees rise by conventional methods of measurement; 25 degrees be taken as the reference air temperature; with railway motors and similar cases where there are space or weight limitations a rise of 65 degrees be allowed; with class B insulation 125 degrees be taken as the limit, or a rise of 80 to 85 degrees; no temperature correction to be made for variation from 25 degrees air temperature.

Method of Rating Electrical Apparatus.

This report contains suggestions representing the fundamental limits which should be considered in rating electrical apparatus. All apparatus should be rated by output, that for direct-current generators being expressed in kilowatts, and for alternating-current generators in kilovolt-amperes at a definite power-factor. Motors should be rated in both kilowatts and horsepower. Apparatus is divided into six classes depending upon load conditions: (A-1) constant service; (A-2) continued, periodic service with alternating conditions of load and rest; (A-3) continued pulsating service with varying load; (B-1) short-time constant; (B-2) short-time periodic; (B-3) short-time pulsating. Temperature conditions are discussed and the same limits advised as by the subcommittee on temperature and insulation, with an excess allowance of five degrees for short-time service. Parts of the apparatus which do not come in contact with the insulation, such as bearings, may have any temperature that will permit of safe operation. Apparatus in class A-1 should be rated upon a basis of ultimate temperature without other limits of capacity being exceeded, and no overloads should be specified except momentary overloads not exceeding 60 seconds. Motors should have a maximum torque not less than 150 per cent of normal rated torque. Commutators should handle 150 per cent of rated current. Alternating-current machines should carry momentarily 150 per cent of rated current. All types of rotating machines should operate with mechanical safety at 25 per cent above rated speed. Water-wheel generators should be constructed for the maximum runaway speed which can be reached. It is suggested that a system of name-plate stamping be adopted which will designate the apparatus according to above classifications and include an equivalent stand test.

The discussion on these reports was opened by C. P. Steinmetz, and was of a general nature. He referred to the history of the Standardization Rules and pointed out that while the reciprocating engine, which was formerly the customary prime mover, was rated at the output which gave maximum efficiency, the steam turbine, which was rapidly supplanting it, is best rated at its maximum output. This has its effect upon the rating of electrical generators, which are usually rigidly connected to the prime mover on the same shaft and which must be rated in accordance with the prime mover itself. Since the reciprocating engine had an overload capacity it was natural to rate the electrical generator upon the same basis. With the steam turbine, however, it is more logical to rate the generator upon the basis of its maximum capacity without making any allowance for overloads. The tendency to abandon overload ratings is also noticeable with respect to the receivers of electrical energy. A single rating, whatever its value, is preferable to a multiple rating. Dr. Steinmetz referred to the former methods of revision, by which the opinions of the membership were usually learned only after the revision had been made. In the present case the effort was being made to secure the co-operation of the

membership before revision. It is not the function of the committee to legislate, but only to record natural industrial laws as they become apparent. The Rules must deal with results and not with the means of attaining them. The latter would retard development.

B. G. Lamme also commented upon the first report.

James Burke, H. G. Stott, Leo Schüler, H. U. Hart, W. L. Waters, B. A. Behrend, J. M. Smith, F. B. Crocker, Charles Robbins, S. S. Wheeler and Philip Torchio joined in the discussion at this session.

Mr. Schüler favored doing away with overload capacity, which is the main difference at present between the American and the German rules. At the recent committee meetings of the International Electrotechnical Commission at Zürich, an agreement was reached which was quite similar to the proposal in the first committee report. However, instead of specifying the temperature rise, the ultimate temperature was specified to be 90 degrees for impregnated cotton, 80 degrees for dry cotton and 95 degrees for coils entirely impregnated, since in these the temperature gradient is estimated to be less. A room temperature of 30 degrees was considered a better average than 40 degrees, since perhaps not more than one per cent of all the machinery in use was located in steam stations. Referring to the classification of motors in the second report, he stated that in Germany there are now in use both continuous and limited ratings. In the latter case the time, such as 10, 30, 60 or 90 minutes, is stated upon the name plate.

Mr. Waters thought it would be ill advised to fix the rules for measurement of internal temperatures at the present time. He thought the rules should indicate methods for the measurement of external temperature and state that higher temperatures usually exist internally. The temperature rise is not alone decisive in fixing the life of the apparatus, which depends on the choice and method of use of the insulating materials and the quality of workmanship used in applying them. At the present time we can not determine the maximum temperature in the interior of a machine.

Mr. Behrend favored single ratings, but considered rigid standardization as dangerous, and likely to handicap the industry. The designer has always had to struggle with the old Rules, as the prestige of the Institute made it difficult to break away from them even where they were fallacious, as in the case of temperature rise. The Rules should be as general as possible.

Professor Crocker objected to the abandonment of overload ratings on the ground that most electrical apparatus is self-destructive in the sense that it will carry any load that may be placed upon it, even though in excess of its safe capacity. It differs in this respect from prime movers, and the customer should be protected by an ample margin. Like a number of the other speakers, he assumed that the single rating gave no margin, but that any overload would carry the temperature above the prescribed ultimate limit and injure the machine, and that the new basis of rating would result in giving the same machine a higher rating than at present. He thought the purpose of a standard is to protect the public against ignorance on the part of the buyer and unscrupulousness on the part of the seller, and the single standard would do neither. Electrical machinery should be rated with a factor of safety similar to that used in other engineering structures. Similar sentiments were expressed by Mr. Smith and by Dr. Wheeler, although the latter approved a single rating under the proper conditions.

Mr. Robbins stated that the new rating gave more margin than the old, since the allowance of 50 degrees was figured on a room temperature of 40 degrees, which was regarded as a maximum and not an average room temperature. There was thus usually a margin, or factor of safety.

Mr. Torchio expressed the standpoint of the central-station user of apparatus. He considered the maximum rating suitable for prime movers and generators, but not for transformers, rotary converters and other apparatus subject to overloading, especially when not under the control of an attendant. It is not logical to rate the latter on the same basis as a steam turbine. The specifications of the New York Edison Company are more conservative than those of the American Institute. Nevertheless, they have had trouble from local overheating, and no change should be made in the present rules which would result in raising the rating of a machine.

Wednesday Afternoon Session.

The afternoon session convened promptly at 2 o'clock, and the discussion was resumed, those participating being: M. G. Lloyd, C. P. Steinmetz, H. G. Reist, B. G. Lamme, Alexander M. Gray, R. F. Schuchardt, H. M. Hobart, C. E. Skinner, J. M. Smith, James Burke, Philip Torchio, C. J. Fechheimer, Charles Robbins, B. A. Behrend, W. L. Merrill, W. H. Powell, C. F. Scott, C. A. Adams, C. L. de Muralt, A. E. Kennelly and A. M. Rossman.

Dr. Lloyd called attention to the distinction which should be made between capacity and rating. The capacity of a machine depends upon a number of local conditions not inherent in the machine, such as room temperature, wave form, etc. Rating should be based upon the capacity under certain specified standard conditions, but need not necessarily represent the ultimate capacity under these conditions, or any other conditions of actual use. If the rating were definite, however, any user could determine what the capacity would be under his own conditions. The sub-committees had seemed to take this view with respect to room temperature, and some of the other variables, but the reports seemed to imply that in other respects the rating might be so defined as to depend upon the conditions of use. This is not desirable.

Dr. Steinmetz explained that a single rating did not necessarily represent the maximum output, and need not necessarily be any higher than a rating under the present method. The margin, however, should be definite and then this margin can be fully utilized when necessary, as under conditions of maximum load. If the rating represented the ultimate capacity, then the user would have to subtract the required margin to get the regular load. He also pointed out that the proposed new method of rating, as outlined by the committee, would not result in rating a machine at a higher value than under the present rules. Mr. Lamme also stated that the temperature limit was being lowered.

Mr. Reist concurred in these ideas. The overload idea had been carried over from the steam engine, which was rated at the point of highest efficiency. This was also true of the water wheel and the gas engine. Electric motors should be rated similarly. Motors as now generally used are frightfully underloaded. For non-continuous load he favored a method like the German, where the length of time for a given load was stated, rather than the classification given by the committee. He favored a low working temperature rather than a limiting temperature.

Professor Gray stated that the insulation was not always the limiting feature in rating. For example, on the basis of the aging of iron, 90 degrees might be too high a temperature of operation. He would cut motor ratings to three classes: continuous, intermittent and short-time. After loading, a motor cools more rapidly under light load than at standstill, owing to the circulation of the air. He pointed out that the present rule is not clearly understood regarding ratings at low power-factor. Thus, 100 kilowatts at 80-per-cent power-factor is defined to mean 100 kilovolt-amperes, but is often taken to mean 125 kilovolt-amperes. He

thought the bearings should be limited in temperature, and that the date of manufacture should be placed on the name plate.

Mr. Schuchardt, speaking from the central-station standpoint, favored a single rating representing continuous load, but with a margin. The other five classes of motors represented too great a multiplicity of ratings. He mentioned the effect of such a multiplicity on central-station rate-making, where the value of maximum demand enters and is based upon connected load. It is desirable to rate transformers on a basis permitting two hours of overloading. He disapproved of the use of the Institute label upon motors. Commutating machines should have the ability to commutate a 200-per-cent load; rotary converters should be able to withstand a speed of 25 per cent above normal. The Commonwealth Edison Company uses exploring coils to determine temperature, and has adopted 80 degrees as a maximum temperature determined by this method.

Mr. Hobart favored an equivalent rating for motors in the non-continuous classes. A factor of safety should not be included in the rating, but should be left to the choice of the customer, since it was not a uniform requirement. Mr. Robbins also agreed that overloads cannot be standardized.

Mr. Skinner pointed out that the Underwriters' wiring rules require a size of wire based upon the name-plate rating. He estimated that the new method of rating proposed would require leads 30 per cent larger than before.

Mr. Burke pointed out that the two reports differed in basing the actual maximum temperature at 90 degrees and 100 degrees, respectively. The principal point brought out in the discussion had been a recognition of internal hot spots. A great deal would depend upon the rules adopted for temperature measurement; if these really give the hot-spot temperature the rating would be more conservative than now, since there is sometimes a temperature drop as great as 20 degrees between the inside and outside of a machine.

Mr. Fechheimer pointed out the effect of the proposed rule on induction motors, whose maximum efficiency is at about three-quarters of full load. If ratings are raised they would be operated at a lower efficiency.

Professor Adams pointed out the two functions of a rating: (1) to secure uniformity, so that the prices of different manufacturers can be compared directly; (2) to properly choose a machine for a given duty or service. Ratings can not cover all conditions of service, but if ratings are uniform and are understood, a proper choice can be made. The rules should not be distorted for the sake of the ignorant customer. What is desired is simplification and standardization. They should make the manufacturer specify where and how to measure the temperature, and state the measured rise which will prevent any spot in the machine from getting too hot. Profesosr Scott considered that the rules should consist of a definition of terms and specifications as to methods of test.

Professor de Muralt thought that the rating should be such as to protect the insulation, but pointed out that there were other limits to capacity, such as the load that would stall an induction motor, the limit to commutation on direct-current machines, etc., whereas the discussion had been confined entirely to the question of insulation and temperature. He objected to the six classifications for motor ratings, and thought it should be shown merely how motor behavior on typical runs would compare with performance on continuous runs.

A motion was passed for extending invitations for comment upon the proposed revisions and the committee reports to the National Electric Light Association, the American Electric Railway Association, and the Association of Edison Illuminating Companies. To be considered, such comment must be presented within one month.

Written discussion was also submitted by E. A. Wagner, C. E. Allen, and G. I. Stadeker. Mr. Wagner pointed out that the same machines often included both class A and class B insulating material, and there would be difficulty in classifying apparatus as proposed in the report. It might be argued that if any cotton were present the apparatus belongs to class A. In this case classifications should be limited to two, one class which can burn out, and another which can not, such as heating elements. The second report left autotransformers out of consideration. These have sometimes been rated by the amount of work transformed, this being considered as the output. Recently the practice has been adopted of rating both in kilovolt-amperes transformed and kilovolt-amperes output. The one rating without the other may be very misleading, and he favored this double rating.

Mr. Allen believed that durability of insulation must be considered not only from the mechanical and electrical standpoints, but with regard to the method of preparing and applying it. This has been radically changed of late years, and the apparatus now put out is of more uniform quality with respect to insulation than formerly.

Mr. Stadeker advocated a gradual change in rules rather than a complete overhauling at one time. For example, a change in rating of motors from horsepower to kilowatts at the same time that the basis of rating with respect to temperature was changed might result in much confusion and misunderstanding. He illustrated this by an example.

Heating, Heat Measurements, and Rating by Heat.

At the session on Wednesday evening the presentation and discussion of the papers in Group 1 was taken up. The following papers were presented in abstract: "Notes on Internal Heating of Stator Coils," by R. B. Williamson; "Measurement of Temperature on Rotating Electric Machines," by L. W. Chubb, E. I. Chute and O. W. A. Oetting, presented by Mr. Chubb; "Method of Determining Temperature of Alternating-Current Generators and Motors and Room Temperature," by H. G. Reist and T. S. Eden, presented by Mr. Eden; "Thermo-Couples and Resistance Coils for the Determination of Local Temperatures in Electrical Machines," by J. A. Capp and L. T. Robinson, presented by Mr. Robinson.

Heat Measurements of Moving Machinery.

Mr. Williamson's paper deals with the problem of internal heating of stator coils for alternating-current generators, particularly those with long cores in which little heat can be conducted from the center of the machine to the ends. In such generators the heat must pass out to the iron through the insulation, and it is important that the probable temperature difference between inside and outside of the insulation be known at least approximately. Heat-conductivity coefficients for various kinds of insulating materials are given, and a method of calculating the temperature-gradient described. Some examples of tests made to determine the difference in temperature between inside and outside of coil are also included. The other papers discuss different devices for measuring temperatures in electrical machines and point out their various sources of error and also limitations. Fluid thermometers can generally measure only surface temperatures, and temperatures of rotating parts must be measured after they come to test, thereby introducing large changes of error due to equalization or rapid changes of temperature. In the measurement of temperature by the electrical-resistance method either the windings of the machine itself or fine-wire coils placed in or about the windings are employed. In using the coils of the machine, the result gives only the average temperature of the whole length of the winding and does not indicate the temperature of any part. Where coils of fine copper are used, highly accurate measurements are possible, but some sort of bridge for determining the resistance is required. The thremo-couple is the most accurate device for measuring local temperatures. A very con-

venient method of employing thermocouples is described and results showing the heat distribution in an electric generator are given. The question of the temperature of the air that actually cools a machine is discussed. Thermometer measurements are further discussed in regard to their application to machines, showing lack of uniformity on account of the various coverings and pads that may be used. The method of stopping the rotating element is also referred to in regard to taking shut-down temperatures. Among the recommendations made are the following. Mercury thermometers should be used for exposed parts, and a definite covering for bulbs recommended. The resistance method should be confined to windings of uniform temperature, or even to rotor windings where thermometers cannot be applied, and should not be used for windings of very low resistance. Special coils should be used for machines of large capacity and of 6,600 volts or over. Rises of temperature should be based on cooling air, whose determination should be standardized. Thermocouples are preferable to exploring coils, and when used for internal temperatures on revolving parts, readings should be taken after shutdown. The best method for stopping a machine is by field excitation, using full field.

This group of papers was discussed by C. P. Steinmetz, W. A. Durgin, B. G. Lamme, M. E. Leeds, L. W. Chubb, L. T. Robinson, R. F. Schuchardt, Leo Schüler, A. E. Kennelly, James Burke, F. D. Newbury, B. A. Behrend, C. A. Adams, W. F. Dawson, A. M. Gray, R. B. Williamson, C. J. Fechheimer and Ralph D. Mershon.

C. O. Mailloux explained that at the recent meeting at Zürich of the committees of the International Electrotechnical Commission, to which he had been the American delegate, he had abstained from voting upon the questions involved in the present discussion on account of the uncertainty as to what would be the outcome of the reports and papers then in course of preparation, and of the discussion at this meeting.

Mr. Durgin stated that the Commonwealth Edison Company made use of exploring coils for determining temperatures, and that some of these had been in use since 1897. In addition to their use in obtaining actual temperatures, which turned out to be as much as 30 degrees higher than when measured by other methods, they were good indicators of clogging of the slots of the machine with dirt and the consequent necessity for cleaning. Mr. Schuchardt added that No. 30 copper wire was used, and 90 per cent of them remained good. The exploring coil was favored by Messrs. Leeds and Robinson, while thermocouples were preferred by Mr. Chubb. Mr. Lamme stated that either might be advantageous in certain cases where the temperature gradient was large. Dr. Steinmetz stated that the temperature shown depended upon the position of the exploring coil or thermocouple, and that while either might be a good indicator it did not necessarily disclose the hot spot or its temperature. Mr. Schüler gave an example illustrating this. Mr. Lamme pointed out the difficulty of using either method on the rotating parts. He favored the use of an exploring coil as a research in getting the correction to be made to temperature measurements by the more usual methods, and it would then not be needed commercially. In a two-layer winding Mr. Dawson favored putting the exploring coil between the two. Professor Gray had once found a temperature of 127 degrees between the two windings on a 6,000-kilowatt machine.

Mr. Fechheimer pointed out that the temperature rise is not proportional to the total loss in watts, but is more nearly proportional to the sum of the rises due to the losses separately. Regarding Mr. Williamson's paper, Mr. Dawson pointed out that specific heats as well as thermal conductivities were important in determining the rate of rise. The values are frequently three or four times as large as for copper, and the English National Physical Laboratory has given out values six times as large.

C. P. Randolph presented a written discussion emphasizing some of the points brought out in Mr. Williamson's paper, and pointed out that the calculation of heat losses and the distribution of temperatures is very complex and often practically impossible of solution. However, the points of high temperature may often be located by the exercise of good judgment. The actual temperature of the insulation which limits the output of a machine depends not only on the temperature of the surroundings, but also on the heat conductivity of the insulating materials, iron, etc., and upon the surface properties of the machine. The conditions may be changed by painting the external surface.

Transformers.

The next group of papers dealt with heating of transformers, and included the following: "Methods of Determining Temperature of Transformers and of Cooling Medium," by S. E. Johannesen and G. W. Wade, presented by Mr. Johannesen; "Methods of Measuring Temperature of Transformers," by C. Fortescue and W. M. McConahey, presented by Mr. Fortescue. There was no discussion of these papers.

Methods of Determining Temperature of Transformers and of Cooling Medium.

The paper discusses methods of determining the effective temperature of the cooling medium and the actual temperature of heated transformers. Particular attention is called to the errors resulting from variations in the temperature of air during a heat run on a self-cooled oil-immersed transformer because of the slowness of the large mass of material in following changes of temperature in the surrounding medium. It is pointed out that the effective temperature of the cooling medium is practically the average temperature of a duplicate transformer, subjected to the same cooling conditions and without load. This temperature should be used as the base for calculating rises. Methods of measuring hot temperatures by rise in resistance are discussed. Attention is called to the advantages obtained by comparing resistance of the loaded transformer with that of a duplicate idle transformer. The cooling of windings after load is removed, but before resistance readings are obtained, causes an error in the determination of the temperature rise. This drop in temperature can be avoided by measuring the resistance of the windings without cutting off the load. A method of doing this is described. Actual test results are given to show the advantages gained by using a duplicate idle transformer as a base for determining temperature rises. Instructions for using such an idle unit are also given. The paper ends with recommendations for additions to the rules to the effect that duplicate idle transformers be used whenever possible as a base for determining temperature rises.

Method of Measuring Temperature of Transformers.

A discussion of tests to determine efficiency of cooling is given. Rules are given for determining approximately the maximum temperature of the windings. Standard methods of loading transformers are described. The direct loading method is rarely used, on account of the expense involved. The artificial methods at present in use are applicable only when two or more similar transformers are available. The alternate open-circuit and short-circuit method is described. It is used when there is only one transformer on order. Theoretical proof of the method is given. Tests made by the new method on both self-cooled and water-cooled transformers are given. These tests are found to agree closely with results obtained with standard tests.

The following papers dealt with the question of correction of temperature found in test runs for the temperature of the surroundings: "Correction of Transformer Temperature for Variation in Room Temperature, Taking into Account Both Copper and Iron Losses," by C. Fortescue; "The Temperature Rise of Stationary Induction Apparatus," by J. J. Frank and W. O. Dwyer, presented by Mr. Frank; "Effect of Room Temperature on Temperature Rise of Motors and Generators," by M. W. Day and R. A. Beekman, presented by Mr. Day; "Effect of Air Temperature, Barometric Pressure and Humidity on the Temperature Rise of Electrical Apparatus," by C. E. Skinner, L. W. Chubb and Phillips Thomas, presented by Mr. Skinner; "A Laboratory Investigation of Temperature Rise as a Function of Atmospheric Conditions," by C. B. Blanchard and

C. T. Anderson, presented by Mr. Skinner; "Laws of Heat Transmission in Electrical Machinery," by Irving Langmuir, presented by S. Dushman.

Influence of Air Conditions on Temperature Rise.

Mr. Fortescue and also Dr. Langmuir have studied the loss of heat due to convection, conduction and radiation. The latter finds that radiation and convection are about equally effective in dissipating heat from a surface. He gives tables for the relative emissivities of different bodies and for the heat conductivities of materials used in electrical apparatus. The temperature coefficient of conductivity differs considerably for different classes of materials. Mr. Fortescue derives formulas for correcting temperature rise for bodies consisting of copper only, and of copper and iron. All of the authors agree in finding that the correction for room temperature is negligible and in some cases may be in the opposite sense from that given by the present Institute rules. Messrs, Frank and Dwyer, and Messrs. Skinner, Chubb and Thomas have studied the effect of barometric pressure and humidity, as well as air temperature. The former make the following recommendations:

Variations in Room Temperature.—On all classes of apparatus except air-blast, no correction. On air-blast, follow the present rules. On water-cooled apparatus reference should be to in-going water and this temperature and that of the room should be as near 25 degrees centigrade as possible.

Variations in Barometric Pressure.—For self-cooled apparatus, follow present rules. For water-cooled apparatus, no correction. For air-blast apparatus, double the present allowance.

Variations in Humidity.—No corrections for variations in humidity except in case of fog-laden air.

Messrs. Day and Beekman arrive at the same general conclusion for motors and generators as the other authors have found for transformers.

These papers were discussed by James Burke, H. M. Hobart, C. P. Steinmetz, A. E. Kennelly, L. W. Chubb, Selby Haar, Leo Schüler and Robert Lundell.

Dr. Steinmetz stated that the correct law had not yet been formulated and it had consequently been recommended to make the room temperature during test as near as possible to 25 degrees and then make no corrections. Mr. Burke stated that a temperature correction was necessary. The results found in the different papers were consistent, as he demonstrated in a written discussion which was not presented in full. Mr. Lundell considered that the results given for the effect of room temperature indicated that machines had been used having low efficiency at low load; that is, large constant losses. If machines had been used having high efficiency at low load the results would have been different because the I^2R losses would then have been more prominent. Mr. Schüler regarded the idea that room temperature does not affect the rise revolutionary, and his question regarding fog-laden air was answered by Mr. Hobart, who advocated its use of a cooling medium.

Dr. Kennelly referred to Dr. Langmuir's theory of convection, which assumes a stationary film of air at the surface dissipating heat. He doubted whether this assumption agreed with the facts, but since the formula derived from it gives correct empirical results, there can be no objection to it. He stated that the law of proportionality to the square root of the pressure holds for loss by convection.

Cable Heating.

Two papers were presented dealing with the heating of cables, as follows: "Current Rating of Electric Cables," by R. W. Atkinson and H. W. Fisher; "The Heating of Cables Carrying Current," by S. Dushman.

Current Rating of Cables.

This paper is a discussion of the current-carrying capacity of electric-power cables. The limiting temperatures are discussed. The relation of the temperature rise of cables suspended in free air to the rise under other conditions is considered, the rise in free air being treated specifically, furmulas being given for the calculation of this rise. The rise of temperature with loads of brief duration is discussed. Tables are given showing permissible overload ratings, these tables being applicable under all ordinary conditions.

The Heating of Cables.

The current-carrying capacity of an insulated cable may be calculated from data on the thermal resistivity of the insulation and of the surface. It has been shown that such data may be obtained for any type of insulation from experiments on the cable itself, by applying a well known method for determining heat conductivities. As a result of experiments different types of cable insulation, values are given for the thermal resistivities. These data have been used to calculate the carrying capacities of standard rubber and varnished-cambric-insulated cables in air. It has been shown that the current density and the ratio of the outside diameter to the cross-section are connected by a definite equation. The effect of the surface resistance on the carrying capacity has been shown to be much greater, in general, than that of the internal thermal resistance of the insulation. The magnitude of the surface losses is thus of great importance in determining the current-carrying capacities of cables.

Mr. Fisher made some remarks preliminary to the presentation of his paper, in which he stated that the limiting temperature for paper insulation should be from 66 to 70 degrees. A temperature of 94 degrees soon rots paper. He pointed out that the dielectric loss increases rapidly at the higher temperatures and this factor in heating may in itself become important under such conditions. It was also stated that an appendix had been added to the paper since it was printed, giving data regarding the heating of cables in conduit. Mr. Atkinson then abstracted the paper.

These papers were discussed by C. W. Burrows, Comfort A. Adams, S. Dushman, W. F. Dawson, R. W. Atkinson and H. M. Hobart. Written discussion was also submitted by E. D. Edmonston and D. W. Roper. The effect of painting the surface of the cable was mentioned. Dr. Burrows pointed out that the large size of wire used by Mr. Dushman in his thermocouples might result in a large error in the temperature due to the heat conducted away by the wire.

Mr. Edmonston pointed out the dearth of information regarding the heating of cables in conduit, the values given in the paper referring to cables in free air. He also referred to some trouble which had been experienced in Baltimore, where a number of cables in separate underground ducts had broken down at the same point, closely following one another. He attributed this to the fact that the heat generated at the time of one breakdown had distilled sufficient moisture from the insulation of the neighboring cables to start trouble in them. Laboratory tests to confirm this showed that as much as one or two grams of water could be obtained from a five-inch length of cable. Mr. Fisher had made similar experiments and could not agree that this was the source of the trouble. He thought it more likely that some local condition was responsible for a higher temperature than normal at the point of breakdown, such as the nearness of a steam pipe or poor conditions for dissipating heat. Mr. Edmonston recommended that a standard specification for cables, especially high-tension cables for underground service, should be drawn up by the Institute, and Mr. Fisher agreed that this would be of advantage to both manufacturers and users.

Mr. Roper pointed out that the dielectric loss in cable insulation increased rapidly as the temperature rose, and a point might be reached in practice where this source of heating would be sufficient to maintain a high temperature after the latter had first been produced by over-loading. The temperature might even continue to rise after the load was removed, resulting in the ultimate breakdown of the cable under a low load.

Methods of Determining Losses in Apparatus.

The three sessions on Thursday were devoted to the papers of the second group, dealing with methods of determining losses in apparatus. The first section of these dealt with induction motors, as follows: "Induction-Motor Load Losses," by H. G. Reist and A. E. Averrett; "Stray Losses in Induction Motors," by A. M. Dudley; "Notes On

Induction-Motor Losses," by R. W. Davis.

Losses in Induction Motors.

Load losses determined by the present Institute rules are too high. Load losses are largely in the form of excess core losses, due to saturation of the teeth. With conductors of certain types excess loss may also appear. Fixed loss should be taken as the power input unloaded when running at rated voltage minus the stator copper loss produced by the magnetizing current. The stray or eddy-current loss in the stator copper is found by Mr. Davis to be proportional to the stator copper loss, the percentage depending upon the degree of lamination and averaging six per cent in 25-cycle and 60-cycle machines. He advocates adopting this average percentage as standard. In squirrel-cage motors and small wound-rotor motors with slip under two per cent, the total rotor loss should be determined from the slip reading at full load. In large wound-rotor motors with slip over two per cent rotor loss should be taken as copper loss from resistance measurement. Messrs. Reist and Averrett gave test results showing the effect of tooth saturation and excess copper loss. Comparisons of input-output tests with direct measurements of loss average 0.75 per cent less by direct measurement. In two tests excessive load losses were found due to peculiar construction. They find no excess copper loss in wire-wound stators. Mr. Dudley recommends that Section 167 be revised so as to include a method of determining the load losses of all classes of motors from readings taken at standstill. This will permit the calculation of the true efficiency from no-load and standstill readings.

The Myriawatt.

Before beginning the discussion of these papers, H. G. Stott made a few remarks regarding the use of the "myriawatt" as a unit in connection with boiler rating. With modern conditions of superheating and vacuum he considered it meaningless to express efficiencies of prime movers in pounds of steam per kilowatt-hour. It is necessary to consider the number of thermal units involved, but the use of the old thermal units is undesirable. He thought the use of the centigrade degree should be introduced in thermodynamic calculations and favored the publication of steam tables in terms of degrees centigrade. He pointed out the disadvantages of using the unit known as the boiler-horsepower, and regarded the substitution of the "myriawatt" as the first step in the direction of the use of more rational units. This step was desirable because it involved merely a change in name, as the "myriawatt" differs by only a slight percentage from the boiler-horsepower.

Leo Schüler said that he preferred using the kilowatt to the "myriawatt," which involved only the shifting of a decimal point. The prefix "myria," though usually given in metric tables, is not used at all in Europe. The Verband Deutscher Elektrotechniker has decided to rate motors two years from now in kilowatts, although this involves changing commercial sizes to give ratings in round numbers in the new unit.

H. M. Hobart considered the American short ton the principal stumbling block to the introduction of decimal units. He has published, some years ago, steam tables in terms of kilograms, kilowatt-hours and centigrade degrees, but had not found that they were used by any one except himself.

C. P. Steinmetz gave an example of the awful mixture of units occurring in American practice, and advocated transforming all quantities into metric units at the beginning of a calculation and transforming back at the end in order to avoid mistakes. He thought college professors should teach the use of metric units and not try to pose as "practical" men by inflicting upon their students the worst forms of current practice. If the younger men learned the advantage of the simpler units the change would gradually come about in practice.

Comfort A. Adams criticized engineers who, while seeking fractions of a per cent in the efficiency of apparatus, neglected human efficiency so sadly by retaining a cumbersome system of units. He thought they should make an effort to change this.

James Burke, B. G. Lamme and L. V. Chubb also joined in the discussion.

The discussion of the above papers then proceeded and was participated in by B. G. Lamme, A. E. Averrett, B. A. Behrend, C. P. Steinmetz, James Burke, H. M. Hobart, Leo Schüler, R. E. Hellmund, C. J. Fechheimer, Comfort A. Adams, A. M. Gray, R. B. Williamson, L. T. Robinson and M. G. Lloyd.

Mr. Lamme stated that the principal load loss consisted of eddy currents in the primary copper. These have been largely eliminated in modern machines, in which there are almost no load losses. Mr. Averrett agreed with this, but thought the rules should cover all cases including bad as well as good design. Closed slots are advantageous in some cases, since they give low core loss. Some users want bar-wound stators on account of the ease of repair. With these the losses appear to be less than they really are. The stator loss may be determined by removing the rotor and using a wattmeter with the stator alone.

The question of the use of the terms "stray loss" and "load loss" came in for considerable discussion. The ambiguity in either of these terms indicated the desirability for some other term such as "extra", or "additional," corresponding to the German word used to represent the same quantity.

R. E. Hellmund stated that the present Rules give losses which are too large. The papers presented are constructive in giving suggestions to improve the Rules. It is necessary to consider the case of closed slots. He did not consider Mr. Dudley's suggestion of using different frequencies practicable except in very large works. He thought Mr. Fechheimer misunderstood Mr. Dudley, whose method is to locate the losses by the frequency method, and then separate them by some other method.

Mr. Fechheimer did not think that Mr. Dudley was justified in separating the eddy losses as proportional to the square of the depth of conductor. For instance, if the stator is wire-wound it may have no appreciable eddy currents. Since the eddy-current loss is negligible at low frequencies, he considered the method of variable frequency preferable.

Professor Gray thought that the loss involved in noise was not properly appreciated and should be evaluated.

The question of losses increasing more rapidly than the square of the voltage brought about much discussion. There was plenty of evidence that the losses were sometimes proportional to a much higher power. Below saturation Dr. Steinmetz maintained that it was impossible for losses to vary more rapidly than the square. Others showed, however, that flux waves in the teeth cause a more rapid rise in the loss. Eddy currents, under various conditions, may account for a more rapid rise, as where contracts are uncertain, where higher frequencies than the fundamental exist, as in the teeth; and laboratory measurements have shown that eddy-current losses do not follow the values computed from the specific resistance of the core material.

Losses in Transformers.

Under the heading of transformers, papers were presented by W. W. Lewis, entitled "Losses in Transformers," and by C. Fortescue and W. M. McConahey, entitled "Stray Losses in Transformers."

Losses in Transformers.

It is recommended by Mr. Lewis that Sections 156 to 159 of the Standardization Rules be amended to define transformer losses as *no-load losses,* including *core* and *dielectric losses,* and *load losses,* including *resistance* and *stray losses,* and that all losses be measured at the operating temperature. The magnitude of the stray loss is shown in a large number of commercial transformers and in a few experimental machines. The relation between the impedance watts and the load losses is discussed, and the conclusion reached that they are practically equal. Results of tests are given, showing the magnitude of the dielectric losses in high-voltage transformers. Messrs.

Fortescue and McConahey recommended that the present method of obtaining short-circuit losses be retained, and that copper loss and regulation be calculated from short-circuit watts and impedance voltage. Copper loss and regulation of a mutual inductance may be derived from its short-circuit loss and impedance voltage. The transformer differs from the mutual inductance, due to the fact that the primary and secondary inductances are functions of the induction in the iron. The equation derived furnishes a method of testing to obtain the equivalent short-circuit loss under full-load conditions. To ascertain if the values of short-circuit loss and impedance, obtained in this way, differ from those obtained in the ordinary way, tests were made by both methods, yielding results which, after proper corrections were made, checked very closely. Results of tests are tabulated. Practical formulas for figuring copper loss and regulation are given.

The discussion of these papers, which extended over into the afternoon session, was participated in by J. M. Weed, C. Fortescue, James Burke, E. A. Wagner, C. P. Steinmetz, Leo Schüler, B. G. Lamme, C. F. Scott, L. T. Robinson, P. M. Lincoln, W. C. Smith and G. K. Kaiser.

Mr. Weed stated that efficiency guarantees should not exclude any of the losses. He pointed out that the test with open secondary should be made at a voltage exceeding the nominal by the resistance drop, not smaller by this amount, as now stated in the Rules. A time limit should be placed upon taking a resistance reading after a heat run, on account of the immediate cooling which takes place upon removing the load.

Mr. Fortescue stated that the loss due to exciting current is not usually recognized, but is of importance at low power-factors. Mr. Wagner thought this should be included in the no-load losses. He advocated stating the volt-ampere efficiency at different power-factors, as did also Mr. Burke. It was disclosed in the discussion that the present practice in regard to short-circuit tests was not uniform, these being sometimes taken at room temperature or 25 degrees, and sometimes at the temperature of operation at full load. Dr. Steinmetz maintained that since the efficiency in operation depends upon the hot values, the old rule requiring these should be retained and adhered to. Mr. Lamme did not think that either practice was entirely consistent with the facts. In order to include the stray or extra losses he favored a copper-loss measurement by wattmeter rather than computation from resistance measurements. He also favored efficiency ratings on low power-factors. Mr. Lincoln also favored the measurement of losses at operating temperatures, and Mr. Smith thought the Rules should state clearly that efficiencies at fractional loads should be based on the operating temperature for full load. Mr. Fortescue thought that this would lead to controversies and that it was sufficient to specify the efficiency at any definite temperature. It can then be computed for any desired temperature.

Brush Losses.

The papers dealing with brush losses were next taken up. These were as follows: "Brush Friction and Contact Losses," by H. F. T. Erben and A. H. Freeman; "Methods of Determining Brush Losses Due to Contact and Friction," by H. R. Edgecomb and W. A. Dick; "Commutation and Brush Losses," by C. E. Wilson. The two latter papers were presented by Mr. Skinner. It was stated in connection with the first paper that an appendix had been prepared by the authors since printing, giving coefficients of friction for leading brushes.

Brush Losses.

Values of contact voltage losses are affected by composition, pressure, temperature, humidity, current density, etc. The value of the power loss is affected by composition, angle of brush, surface conditions, speed, pressure, etc. Test apparatus should control and accurately record all these variables. Two surface variations, which may cause large errors, have been investigated: (1) The change in the surface of the brush due to continued passage of current causes large momentary fluctuations in the values of contact voltage loss. (2) The thin coating of carbon which adheres to the commutator surface decreases contact voltage loss values by forming a conducting medium between brush and commutator. Curves and formulas are proposed which record the effect of the principal variables on each brand of brush are proposed in the second paper.

The relation between the short-circuit or reactance voltage, brush drop and commutation is illustrated by several examples. A machine with difficult commutating characteristics must have a high-resistance brush or it will be very sensitive to sudden changes in load, brush spacing, vibration, etc. The actual current density in parts of the brush is shown to often be two or three times the apparent density. When local currents are eliminated by using narrower brushes, resistance leads or commutating poles, higher apparent densities are permissible. Mr. Wilson states that at present no way of calculating or measuring the actual loss at the brushes is known. At best only a rough approximation can be obtained. Probably in a majority of cases the most satisfactory method of dealing with this loss is to obtain figures for it from brush-loss tests on slip rings or short-circuited commutators. The increase in loss actually occurring can be regarded as a commutation or load loss and as part of the stray losses of the machine.

The first paper calls attention to the insufficiency of the present Standardization Rules of the Institute. A more accurate method of determining the losses is described and rules given for application of the data so obtained to the calculation of brush losses. A recommendation is made for the determination of such losses by calculation.

These papers were discussed by H. F. T. Erben, W. B. Brady, Leo Schüler, B. A. Behrend, A. H. Freeman, A. M. Gray, C. A. Adams, B. G. Lamme, R. B. Treat, W. F. Dawson, John L. Harper, L. T. Robinson, W. H. Powell, F. D. Newbury and L. E. Underwood.

Mr. Erben described an apparatus for determining the true coefficient of friction, based upon a determination of normal pressure and tangential pull. Such values do not agree with those found in experience with actual machines, where different values are obtained with trailing and leading brushes; but they are valuable in showing the differences between materials of different kinds. Brushes wear on one polarity and rings on the other. The abrasive action increases the friction. Humidity decreases friction, but causes an excessive drop at the contact. Mr. Brady pointed out that friction is influenced by humidity, passage of current and so many other variables that it has not been found possible to separate the effects of the various influences. He stated that the coefficient of friction decreases with increasing current. Others gave testimony on the latter point which was found to be conflicting. Mr. Behrend stated that he could explain either effect, but believed that there was really no effect at all. Professor Gray quoted experiments showing how greatly the friction could vary in a short time and the various things that would affect it. Mr. Erben considered these easy to explain, and stated that constant friction occurred only after the brushes were well bedded and in good condition. Little lubricant is necessary when brushes are well made. What is needed is a hard carbon brush containing just enough lubricant. These are now available up to 300 volts, and there is no need of extra lubrication. Much trouble is due to setting brushes at a wrong angle and to too much mica in the commutator. Professor Adams agreed to the latter point after a new machine was once well polished.

Mr. Lamme stated that under certain conditions the passage of current has a large effect upon the friction. In one test magnetic action in the rings had a big effect upon the brush contact. Whether a steel ring has more or less friction than copper depends upon the conditions. Vibration or chattering was often due to a reciprocal action of brush upon holder and holder upon brush; the holder often lacks sufficient

rigidity. A line of similar machines may vary 300 per cent until the brushes are accurately adjusted and seasoned, when the friction becomes nearly equal. Seasoning is necessary to get definite results. Discussion arose as to whether the seasoning should be done by the manufacturer or the purchaser. Mr. Treat stated that seasoning was sometimes accomplished in three hours and sometimes took five weeks. Most machines will meet efficiency guarantees on the factory tests, and any further seasoning is to the customer's advantage. He considered chattering due to the collector ring getting loose on the shaft, even when such a condition was imperceptible upon shutting down.

Written discussion was presented by T. M. McNiece, L. R. Berkeley and E. H. Martindale. Mr. McNiece questioned the accuracy of the formula given in the first paper, and derived a formula for computing the loss due to friction. The decreased friction secured by operating brushes in a leading position may not lead to any net gain, as the contact losses will be simultaneously increased. Contact drop losses are so intimately associated with other commutation losses that their separation seems impossible. In tests for contact drop, radial brushes should be used.

Messrs. Berkeley and Martindale gave test figures indicating a large decrease in the coefficient of friction with increasing current density. This is believed to be due to a graphitization of carbon particles by the small electric arc which carries the current between the brush and commutator. It can not be explained by change in temperature. Heat usually causes an opposite effect. After breaking the current, three to fifteen minutes was required for the friction to rise to the normal value for no current.

Generators and Errors of Tests.

At the evening session on Thursday papers dealing with losses in alternating-current and direct-current generators and with errors in testing were discussed. These papers were as follows: "Determination of Load-Loss Correction Factors for Rotating Electric Machines," by E. M. Olin and S. L. Henderson; "Load Losses of Alternating-Current Generators," by W. J. Foster and E. Knowlton; "Notes on Stray Losses in Synchronous Machines," by F. K. Brainard; "Stray Losses in Direct Commutating Machines," by H. F. T. Erben and H. S. Page; "The Determination of Stray Losses from Input-Output Tests," by L. T. Robinson; "Sources of Error in Efficiency Determination of Rotating Electric Apparatus," by Elma I. Chute and William Bradshaw.

Load Losses in Alternating-Current and Direct-Current Generators.

In all of the four papers in this group the authors advocate finding a correction factor which can be applied to the sum of the separate losses as determined from no-load measurements in order to obtain the total losses under load. In practically all electrical machinery there has been noted a difference between the total losses under load and the sum of the separate losses referred to; this difference is called load loss or stray loss and is due to the distortion and therefore increased core loss resulting from full load and the eddy-current losses caused by fields set up by the useful currents flowing in the conductors. All the other losses can be determined accurately from no-load measurements. A number of carefully conducted tests on different types of rotating machinery were made to determine the difference between the sum of the losses under actual load conditions and their sum as determined from no-load measurements. In several cases commercial input-output tests were also made as a check on the correction factors determined from the previous laboratory tests. Messrs. Olin and Henderson give correction factors for one-half, three-fourth, full and five-fourth load in the case of direct-current motors, alternating-current generators and synchronous motors and 60-cycle synchronous converters. For each type of machinery this factor increases with load. The highest value found was for synchronous motors and 60-cycle converters, each at five-fourth load having a correction factor of 1.2. Synchronous converters for 25-cycles were found to have substantially no stray loss because the correction factor for each load figured out as unity. The paper by Messrs. Foster and Knowlton discussed the subject in general, giving a careful analysis of the various losses. Results of a number of tests were given, but no definite recommendation for the actual value for correction factors could be made on account of feeling on the part of the authors that insufficient tests had been made. Mr. Brainard's paper dealing with synchronous machines refers to some tests which show that in the case of slow or moderate-speed machines the load or stray loss is practically insignificant. In the case of high-speed turbogenerators, however, there is a considerable stray loss, the actual factor for which has not yet been accurately determined. In the paper by Messrs. Erben and Page results of a number of tests on direct-current commutating machines were given. Tentative values for correction factors were also included.

Errors of Tests.

Mr. Robinson's paper on the determination of stray losses from input-output tests discusses the degree of precision that can be expected in efficiency tests of direct-connected sets. The conclusion is reached that such tests can be made to within about one part in 500, which is a higher degree of decision than the limits within which the efficiency can be relied upon to remain constant. Accurate input-output tests under commercial conditions require too much time and involve too much labor to allow of their regular use for general testing, although they are useful as a basis of final reference.

In the paper of Messrs. Chute and Bradshaw it is shown that where the efficiency is determined by the method of summation of separate losses the effect of possible errors in measurement is much less than when determined by the input-output method. In the latter all measurements enter directly into the result so that errors in them have a maximum effect. The authors discuss the causes of different classes of errors, particular stress being laid on those of observation, which are largely caused in commercial operating conditions from excessive swinging of meter pointers. In order to obviate this and other unstable conditions it is necessary to operate under special conditions and to observe all possible precautions in the layout and conduct of all input-output tests, thus entirely offsetting their apparent simplicity. While the efficiency determined by the separate-loss method is not the true operating efficiency, it can be readily modified by certain correction factors for the stray losses in various types of machines, so as to approach very closely to the true operating efficiency, in fact, much closer than in the average input-output test. The latter, therefore, is not recommended.

These papers were discussed by R. E. Hellmund, W. J. Foster, F. D. Newbury, E. F. Collins, B. G. Lamme, H. F. T. Erben, B. A. Behrend, James Burke, C. P. Steinmetz, E. M. Olin, L. T. Robinson, C. J. Fechheimer, A. E. Kennelly, John L. Harper, E. I. Chute, M. G. Lloyd, H. M. Hobart, W. F. Dawson, Ralph D. Mershon, and Leo Schüler.

Mr. Newbury reviewed the three schemes which had been proposed for determining extra losses. He considered the question too complicated to formulate any general rule to cover all machines. Load losses have three origins: (1) core loss increase in the armature due to a change in the flux distribution; (2) eddy currents and hysteresis in surrounding parts due to the stray field of the armature; (3) eddy currents in the armature conductors. He discussed the results of the papers in some detail and drew the following conclusions: (1) Efficiency is most accurately determined by separate measurements of losses including extra load losses. (2) Extra load losses may be determined by direct test when two duplicate machines are available and the importance of the test is sufficient to warrant it. (3) They may be determined approximately in synchronous machines by short-circuit measurements and the use of established correcting factors. (4) In commutating machines they may be determined by established correcting factors. This factor varies with the ratio of maximum induction at no load to that at full load. (5) The determination of extra load losses need only be within wide limits without causing a variation in efficiency greater than the minimum variation in output-input tests.

The use of correcting factors was deprecated by Messrs. Foster, Erben, Behrend, Burke, Lamme, Harper,

Chute and Dawson. Mr. Erben quoted accurate tests on several machines which, according to Olin and Henderson, should have the same value of correction factor of 10 per cent. One of these actually turned out to be six per cent, and another 14 per cent; the latter was a variable-speed machine and at other speeds gave values of 21 per cent and 47.5 per cent. To use such factors the classes would have to be subdivided, giving a multiplicity of correction factors.

E. F. Collins pointed out that most careful work and good conditions were necessary in order that input-output tests should have any value. The errors must be much smaller than in tests for measuring the losses separately. The paper by Mr. Robinson shows what can be done in this line. In using the method of segregated losses all losses should be included. This can now be done in synchronous and direct-current machines, and probably for induction motors.

Mr. Lamme objected to the present rules for determining efficiency as at variance with the facts. With a rotary converter, two values of efficiency could be obtained, depending upon the end of the machine to which measurements were applied. Good machines should not be taken for studying extra losses. He thought that he could guess at the value of load losses as accurately as any of the methods given will measure them. There are several sources of these extra losses, so that no one condition of test will give them all. All methods are approximations, and input-output tests varied so much in results that they were never considered satisfactory unless they gave the expected values. Dr. Steinmetz anticipated trouble for the Standards Committee in agreeing upon any method for the determination of extra losses.

Several of the members present thought that instead of using correction factors all known losses should be measured, and the value of the efficiency determined from these be denominated the "conventional efficiency" as is done in Germany. This idea was supported by Messrs. Harper, Behrend, Schüler, and Lloyd. Mr. Harper thought the rules should be frank in recognizing the real efficiency as a fact and not a thing dependent upon methods. Any short-cut methods should be regarded only as approximations. It was most feasible to make tests of segregated losses at the factory, and tests including all losses after the machine is put in use. These tests frequently differ. Dr. Lloyd suggested that in connection with the "conventional efficiency" the Committee should determine the maximum uncertainty, or difference between this value and the real efficiency, and state it in the Rules. The figure given for this uncertainty could be readily altered from time to time if more accurate knowledge of conditions warranted it.

Mr. Lamme pointed out that while the use of correction factors would give average values for good and poor designs, to which many speakers had objected, the better design would still have the advantage in that the temperature rise would not be so great; this factor set a limit to extra losses.

Written discussion was submitted by Edgar Knowlton, G. F. Brown, L. T. Robinson and E. F. Collins. Mr. Knowlton compared the tests in his own paper with the correction factors given by Olin and Henderson, but the agreement was not very good. He thought the short-circuit core loss a criterion of the load loss, especially in single-phase alternators, even if not actually equal to it. Mr. Brown pointed out the difficulties attending the use of uniform correction factors, especially in machines wound with two conductors per slot of solid bar, sectionalized bar, pressed cable or stranded. In single-phase machines such factors must recognize different types of field design. In machines having wire-wound coils, the load loss is practically the same as the short-circuit core loss, and he gave examples from careful tests showing that actual load losses differed widely from those given by use of the correction factors. He considered the present form of rule desirable, but the fraction of the short-circuit core loss taken should be increased. Where this loss is low its accurate determination is not important, and where high not difficult.

Mr. Collins proposed inserting a direct-current booster in the circuit of Olin and Henderson, with a capacity sufficient to supply the copper loss in the armatures of both motor and generator. He gave the details of test with this change, and an example with actual data, which checked well with input-output tests. Mr. Robinson pointed out the advantages of the booster, which consist in having the same core loss and electromotive force in both machines and supplying the losses electrically. The tests given confirm the reliability and simplicity of the direct methods.

Performance Tests of Generators and Motors.

On Friday morning the papers on methods of testing apparatus for performance were discussed. Those dealing with generators and induction motors were the following: "Comparison of Methods of Loading Large Alternating-Current and Direct-Current Generators and Synchronous Converters for Factory Temperature Test," by F. D. Newbury; "Comparison of Methods of Making Load Tests on Alternating-Current Generators and on Induction Motors," by E. F. Collins and W. E. Holcombe; "Notes on Method of Making Load Tests on Large Induction Motors," by A. M. Dudley, presented by R. E. Hellmund.

Methods of Loading Generators and Motors for Temperature Tests.

When loading back is possible this forms a satisfactory method of running a temperature test. When it is not possible, as where there is but one machine of a size, economy requires some substitute for actual load conditions. Among these the following were discussed: for alternators, (1) zero-power-factor method with either leading current or intermittent and lagging current; (2) separate open-circuit and short-circuit loading; (3) alternate open-circuit and short-circuit loading; (4) open-delta method; (5) phase displacement. Mr. Newbury and Messrs. Collins and Holcombe recommend the adoption of the first method as the one to be preferred for alternating-current generators. For direct-current generators and rotary converters the loading-back method is the only one found satisfactory. For induction motors, the reduced-voltage method and the reversed-rotation method are both found to give temperatures closely approximating actual load. The latter method is preferred by Mr. Dudley. All of the authors discuss the different methods and data from actual tests are presented to show the comparison between actual load and equivalent-load methods. All agree that compromise temperature tests should have recognition in the Standardization Rules.

These papers were discussed by F. D. Newbury, A. E. Averrett, R. B. Williamson, R. E. Hellmund, B. G. Lamme, Leo Schüler, E. I. Chute, P. M. Lincoln, A. M. Gray, B. A. Behrend, H. M. Hobart, S. L. Henderson, J. J. K. Madden, C. P. Steinmetz, W. J. Foster, J. A. Sanford, Jr., and S. S. Seyfert.

Mr. Newbury pointed out that the first two papers were nearly in agreement, but called attention to the points in which they differed. Mr. Averrett also pointed out the agreement by different methods. Mr. Lamme differentiated the different purposes for which tests are made.

The zero-power-factor test was recognized as the best test, as it gives conditions slightly worse than working conditions. Where it cannot be applied, Mr. Williamson favored the open-circuit, high-voltage test, especially for large turbogenerators. He said the short-circuit test alone was of little value, but it would show local heating due to stray losses, and was best for this purpose. He favored using the total value rather than one-third as in the present Rules. Mr. Newbury told of a case where the short-circuit test

did not disclose local heating. He placed the direct-current circulation test next to zero power-factor in value, rather than the intermittent test. It is objectionable only when there is solid material in the rotor. As this condition can be foreseen, it is a safe test. Professor Gray objected that it did not show up eddy-current losses, and therefore some other test was needed. In induction motors, temperature rise is caused mostly by copper loss, hence a test at low voltage and full current is as good as one by reversed rotation. It gives a temperature too low, while reversed rotation, gives a temperature too high. Mr. Hellmund favored reversed rotation, because cheap and convenient. It is a good test only when the core loss is low, but that is usually the case.

Mr. Hobart considered the open-circuit and short-circuit method correct if a short cycle were used, and if other methods disagreed they must be wrong. Mr. Henderson favored it for small machines, but with large ones there is difficulty in getting the temperature quickly enough. Mr. Chute favored simple tests; elaborate ones like this cannot be duplicated in their results. Dr. Steinmetz pointed out that the correct field heating could be obtained by this method if properly arranged.

Mr. Schüler considered equivalent tests dangerous and never entirely satisfactory. They should be placed in an appendix rather than in the Rules. The zero-power-factor test he considered a real test. The open-circuit and short-circuit method is a good one for the shop, but the extra losses must be known beforehand and can then be added half to the iron losses and half to the copper losses. It is not satisfactory for an official test. Mr. Lamme stated that the attitude of the Committee is that useful tests and the errors involved in them should be included in the Rules. Mr. Behrend agreed with Mr. Schüler, and described a method of loading back by dividing the field into two parts and exciting them oppositely. Mr. Lincoln pointed out that this was not applicable to modern two-pole and four-pole generators.

Professor Seyfert suggested a method of artificially loading three-phase generators by connecting to three-phase transformers. The secondaries of the latter are excited by the same frequency in order to supply current for copper loss.

Transformers.

Two papers were presented on testing transformers, as follows: "Load Tests on Transformers," by J. J. K. Madden; "Sources of Error in Transformer Tests," by W. M. McConahey and C. Fortescue.

Tests on Transformers.

Mr. Madden discusses the different recognized methods of conducting load tests on more than one transformer without applying actual load, also methods of making such tests where one single-phase transformer only is available. The actual loading of transformers for test purposes is expensive, and therefore, the motor-generator method is to be preferred. When one unit only is available a heat test may be made which consists in applying intermittently an over-voltage core loss with an over-current impedance loss. Approximate values of temperature only are obtained. Messrs. McConahey and Fortescue consider sources of appreciable error, and methods of eliminating them. The use of instrument transformers should be avoided wherever possible. Stray fields seriously affect readings. The ordinary tests that are made on transformers are enumerated and each one is considered separately.

These papers were discussed by J. M. Weed, C. Fortescue, J. J. Frank, W. F. Dawson and B. G. Lamme. Mr. Weed strongly favored the use of an idle transformer in measuring temperature rise. A small oil cup, which might be satisfactory for room temperature in the case of a rotating machine, would not be for a transformer. Mr. Frank emphasized the fact that the determination of the basic temperature of a run was not confined to transformers, and the same methods would not apply to all. He objected to the over-potential test being the last test applied, as there was then nothing to show whether any damage had been done by it. Mr. Fortescue approved of the use of an idle unit, but such was not always available. The Rules should consider the case of a fluctuating room temperature and state how to determine the temperature to be used.

Friday Afternoon Session.

The papers in Group IV were next taken up. The first of these referred to oil switches. It was by G. A. Burnham, and was entitled, "Rating of Oil Circuit-Breakers with Reference to Rupturing Capacity."

Rating Oil Circuit-Breakers.

The paper advocates a universal method of rating oil circuit-breakers which will be devoid of as many variables as possible. Rating with reference to the aggregate full load of all synchronous apparatus alone is not sufficient to guide in the selection of the proper circuit-breaker, as the location of the switching equipment and interposed lines is of equal importance. If rupturing capacity were rated as "maximum instantaneous," meaning by "instantaneous" the elimination of time-limit relays in tripping, it would eliminate all rating in reference to non-automatic, cell-mounted, pipe-frame, time-limit tripping, etc., and be confined entirely to the switch itself. The author suggests that all circuit-breaking devices be rated with reference to the rupturing capacity on their instantaneous action.

This paper was discussed by P. M. Lincoln, M. G. Lloyd, F. D. Newbury, R. F. Schuchardt and Comfort A. Adams. Mr. Lincoln approved the suggestion for rating oil switches. The ability of the switch to rupture a powerful current depends upon the other devices in the circuit. It is not suitable to rate according to the amount of synchronous apparatus back of the switch. It is customary to overhaul a switch after using it at its limit of capacity. Mr. Newbury would not consider a switch over-rated if after rupturing a circuit under rated conditions nothing more were required than the replacement of contacts. Mr. Schuchardt spoke of the difficulty of rating in such a way that one might know just what the rating means. Users of switches depend more upon their experience with a given type of switch than upon the rating. The behavior of the switch depends upon the amount of power back of it, and he favored rating in terms of the kilovolt-amperes back of the switch which it has ability to rupture rather than upon what it can carry. Professor Adams considered this question a hard one to determine, and considered that the principal aim in the Standardization Rules should be to get a uniform method of rating. The ability of the switch is not measured merely by either the power behind it or the power in front of it.

Spark-Gap Measurements.

Two papers were presented upon the subject of measuring voltages by means of the spark gap: "The Sphere Spark Gap," by S. W. Farnsworth and C. Fortescue, presented by Mr. Fortescue; "The Calibration of the Sphere-Gap Voltmeter," by L. W. Chubb and C. Fortescue, presented by Mr. Chubb.

The Sphere Spark Gap and Its Calibration.

The limitations of the present needle-point spark gap are discussed and the use of a spark gap having two equal spheres is proposed. The space required by a vertical sphere gap having the lower sphere grounded is very much less than that required by a needle-point gap for the same voltage range. Corona and resultant inconsistencies are prevented if the spheres are used over a separation not greater than their diameter. This leads to large spheres for high voltages. Sphere gaps have proved satisfactory in commercial testing because they are reliable, more convenient, require less floor space, and are portable. Spheres of 25, 37.5, and 50 centimeters in diameter, covering ranges of 50,000 to 550,000 volts are proposed as standards and calibrations given. A few features are suggested to be incorporated in the Standardization Rules. Breakdown voltage is independent of wave shape and frequency when expressed in terms of the maximum value of the voltage wave. The relation be-

tween surface intensity at breakdown and ratio of separation to diameter shows the ultimate strength of the air to vary from 30 to 36.6 kilovolts per centimeter.

These papers were discussed by F. W. Peek, Jr., C. E. Skinner, Comfort A. Adams, L. W. Chubb, James Lyman, S. W. Farnsworth, P. H. Thomas, P. M. Lincoln, C. Fortescue, W. S. Franklin, C. P. Steinmetz and J. A. Sanford. It was generally agreed that the needle gap introduced troubles at voltages above 50,000. On the other hand, the sphere gap was very satisfactory at high voltages, and this subject was regarded in better shape for the standards Committee than any other matter which had come before the convention. Work can be performed more rapidly with spheres than with needle points and less room is required for the apparatus. Results can be checked within a small fraction of a centimeter, if conditions are steady. Amalgamation of brass surfaces is no advantage. It is suitable to move the spheres together until breakdown occurs, while insulators or other material under test are connected to the circuit. An advantage of the sphere over the needle point is that slight changes in the surface do not appreciably affect the result. Mr. Farnsworth quoted results obtained abroad as corroborating those presented in the papers. Electrode capacity, humidity and freguency have no effect within commercial limits. The spark potential is proportional to the pressure and inversely to the absolute temperature. With extremely high frequencies, such as 50,000 cycles per second, there may be some effect of frequency, but it has not been definitely determined. The reason the needle gap was introduced in the former Rules was that for low potentials then in question the air gap with spheres was too small for accuracy in measurement, and it is still preferable to use needle points for voltages below 50,000 volts or so.

Considerable discussion was had regarding the amount of energy necessary to obtain a discharge, and the question of time lag of discharge behind application of voltage. It has been shown that where a corona is formed, a certain amount of energy is required for rupture, and there is a corresponding lag.

F. W. Peek, Jr., submitted a written discussion covering his own experiments with the sphere gap. The voltmeter offers reliable means for high-voltage measurement, but a gap method is preferable because measuring the maximum value in the wave. The needle gap is unreliable owing to the effect of previous discharges upon the air, and because it is affected by humidity and the sharpness of the needles. With sphere gaps, humidity has no measurable effect, less space is required, and there is no corona if the spacing does not exceed twice the diameter. He gave calibration curves for spheres of 12.5, 25, 50 and 100 centimeters in diameter. The surface gradient of voltage at spark-over increases with decreasing radius and a formula is given for this relation.

Wave Form.

The following papers on this subject were presented: "Potential Waves of Alternating-Current Generators," by W. J. Foster; "Wave-Form Distortions and Their Effect on Electrical Apparatus," by P. M. Lincoln; "A Proposed Wave-Shape Standard," by Cassius M. Davis.

Wave Forms.

The present wave-shape standard has several objections, principal among which are the use of the oscillograph, the lengthy calculations necessary and the discrimination in favor of higher harmonics. The standard proposed by Mr. Davis makes use of the change of effective reactance of a condenser with change of wave shape. The important advantages are: the wave-shape distortion can be determined very quickly; the distortion depends in a very definite way upon the harmonics present, both as to order and magnitude; the apparatus is very simple and the test easily manipulated. The disadvantage is that it does not show which harmonics are present. The ratio of the condenser reactance on a sine wave to the condenser reactance on the distorted wave is called the distortion ratio. It is conveniently determined by impressing the wave shape to be measured, first on a condenser with a large inductive reactance in series, and then on the condenser alone. The current and voltage at the condenser terminals in each case determine the reactance. Mr. Davis suggests limiting the distortion ratio at no load to 1.15.

Mr. Lincoln considered the effects on the current wave of various attributes of the circuit, and the conditions occurring when synchronous machines of different wave-forms are connected in parallel. Several examples are given of excessive distortion. The indications of power-factor meters are unreliable when harmonics are present.

Mr. Foster discussed certain elements in design that affect the shape of potential waves and showed the effect of load on the no-load wave, giving 90 illustrations of wave forms from practice. Proper shaping of poles, proper distribution of field winding and an incommensurate ratio of slots and poles enable good waves to be obtained.

These papers were discussed by F. M. Farmer, Taylor Reed, C. P. Steinmetz, B. G. Lamme, A. E. Kennelly, M. G. Lloyd, L. W. Chubb, Dougald C. Jackson, Comfort A. Adams, P. M. Lincoln, C. F. Scott, L. T. Robinson and C. M. Davis. Mr. Lamme, Dr. Steinmetz, Mr. Chubb, Professor Jackson and Professor Adams considered the question of changing the wave shape of the generator by variations in the pole face, the teeth and the winding.

Mr. Farmer discussed the limitations in the measurements proposed by Mr. Davis, and pointed out that if ammeters of the soft-iron type were used, they should have a range of 250 milliamperes and would require a capacity of 10 or 12 microfarads, at 25 cycles. A capacity of 50 watts in the transformer used for stepping down would be sufficient. With an ammeter of the proper type, having low inductance, such as a hot-wire instrument, it would be sufficient to use 100 milliamperes with a condenser of one or two microfarads. The other apparatus required would be a standard voltage transformer, a speed counter and a voltmeter of standard type. He suggested that instead of the inductance it would be sufficient to use merely the capacity alone if the value of the latter were known. Professor Kennelly, Dr. Steinmetz and Mr. Robinson favored the latter suggestion. It was generally agreed that the present rule is not satisfactory, the method in vogue being too tedious and not sufficiently penalizing the higher harmonics. Dr. Lloyd pointed out that for some purposes, such as effect upon core loss, the lower harmonics were more important than the higher ones, and gave examples illustrating the effect upon hysteresis of the variations admissable under the rule of Mr. Davis. He considered a saturation ratio of 1.15 to allow too great latitude. Mr. Lincoln considered the limit satisfactory, as the third harmonic is suppressed in three-phase generators, so that its possible effect is not important. As the proposal of Mr. Davis is superior to the present rule it is likely to be adopted.

L. W. Chubb stated the objections to the old rule and the proposed one and suggested the use of a polar diagram in studying wave form. By comparing this with a circle of the same area as determined by planimeter, and considering the extreme variations outside and inside the circle, a measure of approximation to the sine wave can easily be obtained. He uses a machine for analyzing the wave as represented in the polar diagram.

Mr. Reed called attention to the difficulty of connecting waves studied under the old rule with those examined by the new method, especially when the machines were out of reach and nothing but oscillograms of the original wave are available. He considered the proposal of Mr. Davis good in many respects, but thought its adoption should await varied and extended trial.

Regulation.

The last subject for consideration at the convention was that of regulation, and three papers were presented under this head. They were: "The Experi-

mental Determination of the Rgulation of Alternators," by A. B. Field, presented by F. D. Newbury; "Regulation of Definite-Pole Alternators," by S. H. Mortensen, presented by R. B. Williamson; "Generator and Prime-Mover Capacities," by David B. Rushmore and E. A. Lof, presented by Mr. Lof.

Regulation of Alternators.

Since the method recommended by the A. I. E. E. for obtaining regulation of alternators from no-load saturation, short-circuit curve and armature resistance in most cases gives incorrect results, another method called the "triangle method" is suggested by Mr. Mortensen. This method requires the same tests as the A. I. E. E. method, and gives the regulation by means of the Kapp diagram from an estimated full-load zero-power-factor saturation curve, which in turn is determined with the aid of Potier's triangle. Potier's triangle is derived from no-load saturation and short-circuit curve by means of a simplified equation for armature reaction. A series of tables follows, in which regulations obtained by triangle and A. I. E. E. methods are compared with results obtained from actual test. The tables show that the triangle method is the more accurate. Hence the suggestion to supersede the present A. I. E. E. method by the triangle method. Mr. Field recommends basing regulation determinations upon the saturation curve at no load and zero-power-factor load.

Generator and Prime-Mover Capacities.

The importance of the proper adaptation of capacities is fully emphasized by the fact that there are in operation many units in which the output is unnecessarily limited by the prime mover being either too small or too large for the generator. The latter may, for example, be designed for unity power-factor, while the actual operating power-factor may be 0.8, in which case the full capacity of the prime mover can not be utilized. In the past every effort was made to adjust the ratings of the generators to the station load curves, and the result was that overload capacities of 25, 50 or even 100 per cent had to be guaranteed, usually for a period of two hours. This practice is now becoming obsolete and the units are being rated on a continuous rating, which should not be exceeded except during momentary peaks. Steam-turbine units have been rated according to this method for some time past, and with entirely satisfactory results. It is becoming common for waterwheel-driven units, and should prove equally satisfactory for hydroelectric plants, especially for low heads, where the waterwheel efficiency falls off rapidly as the power is reduced below the normal full load. It seems desirable to give all generators a maximum constant continuous rating.

These papers were discussed by F. D. Newbury, S. S. Seyfert, B. G. Lamme, C. A. Adams and A. M. Gray. Professor Seyfert said that synchronous reactance is a fictitious quantity. He considered it better to compute reactance drop from static impedance tests. He had, years before, come upon a test involving the use of Potier's triangle, and gave a full description of this method. Mr. Newbury did not considèr the proposed triangle method very good, and considered a method by calculation made from test data better, as proposed by Mr. Field. Mr. Lamme stated that tests are on record which form exceptions to all the given rules. Professor Adams thought that the measured regulation might err as far from the real value as one obtained by careful calculation. He had tried all methods in a great variety of cases, and would trust his calculation as closely as any results obtained with commercial methods and instruments. Professor Gray considered the method proposed by Mr. Field the best. He referred to the use of the Behrend pessimistic method, and had found many machines running close to the value so obtained. The regulation curve at zero power-factor may be below the curve by the pessimistic method.

Written discussion was submitted by G. B. Smith, Frank T. Leilich and W. L. Waters. Mr. Smith regarded Section 209 of the Rules as an empirical guide in the case of machines running low in saturation with a small leakage reactance and at unity power-factor, but likely to result in large errors under other conditions. The method of Professor Adams, eliminating graphical construction, and computing regulation from armature reaction, no-load saturation curve, armature resistance and short-circuit readings, seems superior. The effect of armature reactance should be separated from armature reaction. He gave formulas for this.

Mr. Leilich stated that the best methods for regulation are long and tedious. Armature reactance may be calculated from design data and could be measured on the test floor. The sine formula, given by Mr. Mortensen for calculating the demagnetizing action of the armature will give close results. Mr. Field has given a method for correcting for increased leakage under load so all quantities affecting regulation can be considered mathematically. Demagnetizing action as determined from short-circuit conditions is not a true measure of its effect normally. A modification of the methods for determining regulation, based upon test measurements of armature resistance and impedance, no-load saturation curve, and field ampere-turns for full-load current at zero power-factor, is suggested and worked out graphically. This method will give results close to actual test.

Mr. Waters considered the triangle method described by Mr. Mortensen, and especially the method of applying it outlined by Mr. Field, the most satisfactory used by designers. He favored getting a load curve for zero power-factor as a reliable basis for determining regulation.

Closing Ceremonies.

Mr. Lamme was then called upon to give a summary of the recommendations made and the conclusions reached. He stated that when the sub-committees went to work they found that temperatures, regulation, losses, etc., could not be measured accurately. The discussion has demonstrated this. One wrong impression which was common is that the errors are greater than they really are, however. Some of the inaccuracies are unimportant. Some of the discussion has been rather discouraging, but some of it is otherwise. We now know our limitations better than we did before. He predicted that the discussion which had been carried on would prove of more benefit to the industry than the Standardization Rules themselves. The convention had set a pace that would be hard to keep up to in the future. It had been put through on schedule time.

Chairman Kennelly then turned the chair over to President Mershon, who made a few remarks regarding the pronounced success of the convention, and expressed the hope that a midwinter convention would become a regular event.

Charles F. Scott made a few remarks on behalf of the Standards Committee. The Committee appreciated the attendance of members, of whom there had been 421 at the convention. He said that the Standardization Rules were sometimes ridiculed, but pointed out that the function of the Committee was not legislative, but rather judicial. Its aim was to pick out the best practice and dub it as standard. There had never before been such co-operation in gathering engineering data; costly experiments had been carried out and the results freely made public; the only aim had been to get at the facts regardless of commercial advantage.

President Mershon gave entire credit for the arrangements and success of the convention to the Standards Committee. He spoke in appreciation of the co-operation of Mr. Schüler and its bearing upon international agreement and comity.

Mr. Schüler responded by congratulating the Institute and the Standards Committee upon the success of the convention.

The convention closed with a reception and ball at the Hotel Astor on Friday evening. The officers of the Institute, with some of the past-presidents, stood in the receiving line. Dancing followed the reception from ten until two o'clock. The ball room was beautifully decorated and contained a large electric sign bearing the letters A. I. E. E., as well as smaller signs with the initials of the other engineering societies.

Society for Electrical Development, Inc.

Big Meeting in New York Develops Many Interesting Phases of Co-operative Effort and Arouses Great Enthusiasm.

(Special Telegram, March 5.)

The Engineering Societies Building, New York City, has been the meeting place for many gatherings of importance in the development of the electrical industry. Representing the allied effort of the great national engineering societies, and housing the headquarters of a great number of institutions devoted to progress along many avenues of scientific and industrial endeavor it is fitting that the epochal conference of the Society for Electrical Development, Incorporated, should be staged amid these propitious surroundings.

The conference opened on Tuesday morning, March 4, with an attendance of over 300 from all parts of country, representing central stations, manufacturers, contractors and jobbers. President Henry L. Doherty announced the objects of the Society and made an address showing the possibilities of co-operation in developing the industry and extending the use of electricity.

Letters from Thomas A. Edison and Charles F. Brush were read regretting their inability to attend and endorsing the objects of the Society. A letter from Charles R. Huntley, president of the Buffalo General Electric Company, reporting subscriptions from two central stations, was read.

J. M. Wakeman, general manager of the Society, made an address on the aims of the Society, showing the need of cooperative work and pointing out some of the ways in which the Society could operate to advantage. This included general educational publicity, electrical shows, demonstrators, moving pictures, popular stories by well known authors, news items in newspapers. Technical papers should be encouraged, and architects, builders and farmers interested in electrical service by articles in their trade papers, solicitors could be supplied for local central-station campaigns.

Frank H. Gale, advertising manager, of the General Electric Company, read a paper on "The News Value of Electricity." The items must have popular interest. Research news interests the technical man but not the general public. An improved lamp for railway service interests all. The news must appeal to the editor or it is scrapped. There is plenty of real news in the electrical field and its many applications. The people's electrical page is unique. Material should be supplied to independent writers. Mr. Gale proposed an electrical week as a general movement throughout the country, combined with securing newspaper advertising, demonstrations, etc. The results of a campaign of this kind would extend much further than is evident at first sight.

A discussion by Messrs. Doherty, Wakeman and Durfee, followed. The latter said that when employees were free to talk to reporters, good relations resulted, and every day some news items, with indirect advertising value were discovered. L. W. Salmos told of his experience with New York newspapers. Copy with real news value was always in demand but press agents were generally blacklisted. James H. McGraw, president of the McGraw Publishing Company, said that the newspapers wanted news in newspaper language, and that he approved the suggestion by Mr. Durfee.

Zenas W. Carter said the public wants information on electrical things. D. T. Pierce, of the *Electrical World*, said the Society should educate electrical men to do their own publicity work. Earl Whitehorne, of *Electrical Merchandizing*, emphasized a necessity for human interest in news items.

At the afternoon session, Frank E. Wallis read a paper on "Electricity and the Architect." He made a plea for cooperation between the architect and the Society, preaching more and better light. There was not enough sympathy between the engineer and the architect. They should have close relations, to their mutual advantage. The salvation of civilization is in light, heat and power.

Talcott Williams read a paper on "The Dissemination of News." Engineers have difficulties largely because they are misunderstood. The journalist always desires to get facts, but accuracy is possible only by educating reporters to understand electrical terminology. The school of journalism of Columbia University aims to prepare men for technical work, especially electrical. It has a course in chemistry and physics. A vote of thanks was tendered Mr. Williams. This paper was discussed by J. I. Ayer, of the Simplex Electrical Company, who thought that salesmen needed the same training as reporters, so as to speak intelligently to customers.

T. C. Martin, secretary of the National Electrical Light Association, read a paper on "Where the National Electrical Light Association Comes In." The National Electric Light Association was ready to cooperate by positive constructive work. America leads the world electrically and the Association supplies the "Juice" therefor. The industry doubles every five years or twice as fast as the population. It should grow even faster. The average income now is five dollars per capita; with some companies on the Pacific Coast it is twenty dollars per capita.

F. M. Tait, president of the National Electric Light Association, referred to the meeting at Association Island when the Society for Electrical Development was born, at which time he was skeptical of its future but now his enthusiasm is rising. The National Electric Light Association is fully in sympathy with the co-operative movement. The individual companies should support it.

H. L. Doherty referred to the Commercial Section of the Association and its rapid development as setting an excellent example to this Society.

J. C. McQuiston, manager of the Westinghouse Department of Publicity, read a paper on "Efficiency in Local Advertising." He depicted probable conditions in the future. He was opposed to the present scheme of having electrical advertisements confined to a people's electrical page. It is better to distribute them throughout the paper. Advertising should be timely. The manufacturer, dealer and central station should advertise the same lines simultaneously. Manufacturers are ready to supply suitable material. Local papers should be encouraged to get news items of the company. Letters by mail are most effective following national advertising. The mailing list should be carefully selected. Mr. McQuiston favored the centralization of copy service. He discussed window dressing and strongly favored moving pictures, especially in schools. Industrial films are now handled by the film companies. The Society should supply electrical films. He also advocated permanent transportable electric shows accompanied by demonstrations and preceded by advertising.

The discussion of this interesting paper was participated in by W. E. Robertson, P. S. Dodd, H. B. Woodill, J. M. Wakeman, Fred Bissell and Mr. McQuiston. Mr. Robertson, who was

the father of the electrical page idea was once proud of it, but now sorry. Once there was no other advertising except that of the central stations and there would be none now if the page stopped. But usually the matter appearing therein is not properly edited. We must have something to take its place. Mr. Dodd said local advertising is efficient when correlated with national advertising.

Mr. Woodill, an electrical supply man of Los Angeles, Cal., said that most contractors don't want the co-operation of the central station but only that of the manufacturers. They prefer the lighting company to keep out of the wiring business. The Southern California Edison Company was a pioneer in price-cutting and dealers have attempted to show it unnecessary.

Mr. Wakeman said one object of the Society is securing harmony. It aims to eliminate price-cutting and to have the dealers develop their own field to the fullest extent. Fred Bissell, of Toledo, O., favored grouping advertising. The trouble has been to get good editing of the accompanying reading matter. The Society can help here. In many respects he agreed with Mr. Woodill.

At the Tuesday evening meeting T. C. Martin gave a condensed discussion of suggestions and ideas received by mail from various individuals, associations and luncheon clubs. Many good suggestions for appropriate activities of the Society have been made, including political and economic activities, cultivation of better relations with the press, educational propaganda, supply of reading matter and exhibits to central stations, help for sales campaigns and demonstrations, acting as a clearing house for merchandising ideas, study of customers and market, having traveling representatives, furnishing books on commercial electrical subjects, etc.

Participating in the general discussion on Tuesday evening were H. L. Doherty, Mr. Bloodworth of Public Service Company, Converse D. Marsh, C. G. Durfee, Robert Ely, Mr. Bailey of Dundee, W. L. R. Emmett, Mr. Barber, Norman Macbeth and G. H. Stickney. Mr. Doherty proposed that central stations endeavor to electrically equip one factory in a certain industry completely to be used as a model in general solicitation. Mr. Durfee said the Rochester central-station company was ready to do it. Mr. Doherty also advocated country-road lighting and the complete electrical equipment of a gasoline automobile of one make as a model. The Peerless Motor Car Company has agreed to this scheme. The obstacles to railroad electrification can be removed in many cases. He suggested that local sections of the Society be organized.

At the Wednesday morning session a paper by J. Robert Crouse on "Co-Operation in the Electrical Industry" was read by Frank E. Watts, Jupiter of the Jovian Order. The paper referred to the early development of the National Electric Light Association and the recent organization of its Commercial Section. Mr. Crouse feels that the second period in the development of the industry is beginning. Referring to the work of the Jovian Order and its slogan and watchword, "Co-Operation," he proposed "Harmony" as the watchword of the Society for Electrical Development. Commercial co-operation is necessary in distribution and selling to secure the highest possible efficiency. Most of this is now done at maximum cost. There are possibilities of accomplishing the desired end through local chapters of the Jovian Order. He referred to the Past Jupiters' Association and proposed a similar organization of past presidents of this society who will pledge $5,000 to $50,000 as a fund for special purposes.

The discussion of this paper was led by E. W. Lloyd, chairman of the Commercial Section, National Electric Light Association, who outlined the work and needs of that body. Electrical salesmen need much help and should be supplied with all possible facts and literature dealing with what they are selling.

A paper was read by James H. Collins dealing with the sales end of the business. The question of success is one of spirit. The details are different in every case. He advocated better selling methods for contractors and jobbers. This business should be recognized as being in the same position as any other business; it should be done on the basis of quality rather than price. The middleman is necessary.

A paper was also presented by W. E. Robertson on "Merchandising Co-Operation." This must involve profit by definition. If the central station charged in the actual cost of selling, the dealer could easily compete and have a decided advantage, due to the hostile feeling still prevailing toward public-service corporations. The jobber must be a keen merchant and can do merchandising better than the central station. In any case, there must be profit to cover the expense of the service. Modern methods of merchandising are necessary, also prominent and convenient location of stores.

Discussion of these two papers was taken part in by Messrs. Doherty and Johnson for the central-station interests. The session was followed by a luncheon with the Jovian Lunch Club at Michaud's Restaurant.

At the afternoon session the discussion was continued by representatives of contractors and manufacturers. A paper was then presented by William D. McJunkin on "An Electrical Advertising Campaign."

The conference was closed on Wednesday evening by a banquet at Delmonico's.

Annual Meeting of Electric Railway Association.

The annual convention of the Electric Railway Association was held at the Washington Hotel, Indianapolis, February 27 and 28. Preliminary to the meeting, the Central Electric Traffic Association, a parent body, met on February 26. The meeting was presided over by W. S. Whitney. A. L. Neereamer, secretary-treasurer, presented the secretary's report, in which it was shown that the past year had been one of the best in the history of the association, the scope of the association being gradually broadened.

The first paper was presented by J. C. Thirwall, on "Economy in Motor Maintenance." Mr. Therwall took up the necessity of the care and thorough cleaning and inspection of the motor.

"The Human Element in Fare Collection" was the subject of a paper presented by John F. Ohmer, of the Dayton Fare Collecting Company of Dayton.

C. O. Sullivan then read an exhaustive treatise on "Interline Freight" which was amply discussed by F. D. Norviél. The matter of operating the present interline freight and the scientific plan of routing carload lots of freight across the country by interurban roads, has been worked out by the association to such a perfection and nicety by the officials and agents of this association as to excite the admiration of the entire country.

At the concluding session of the second day the subject of proper heating of cars was discussed. In the discussion there was much difference of opinion. Many acknowledged that they have much trouble along that line. It was admitted that about 75 per cent of the interurban cars operated during the past winter were deficient in heat and too cold to be satisfactory. This is a matter to be improved during another winter.

The following officers and executive committee were elected: President, A. W. Brady, president of the Union Traction Company of Indiana, Anderson, Ind.; first vice-president, E. F. Schneider, general manager of the Cleveland, Southwestern & Columbus railway, Cleveland, O.; second vice-president, C. L. Henry, general manager of the Indianapolis & Cincinnati Traction Com-

pany, Indianapolis; secretary-treasurer, A. L. Neereamer, Indianapolis; members of the Executive Committee, H. A. Nicholl, general manager of the Union Traction Company of Indiana: W. S. Whitney, general passenger and freight agent of the Ohio Electric Railway; C. N. Wilcoxen, general manager of the Chicago, Lake Shore & South Bend railway; J. H. Crall, general passenger and freight agent of the Terre Haute, Indianapolis & Eastern; R. A. Crume, general manager of the Dayton & Troy Electric railway; F. W. Coen, general manager of the Lake Shore Electric railway; E. L. Kasemeier, president of the Central Electric Railway Accountants Associations.

An Interesting Service Performance of Meter.

It is a matter of interest that after 17 years of continuous service, meter No. 1 of the New York Edison Company, is still in use. Quite by accident was the discovery made that the oldest meter was still a long way from the junk pile, and the investigation that followed that discovery revealed some very interesting facts regarding its wanderings.

It came to New York with the first shipment of the present type of meters, in the summer of 1896 and after being tested was installed in a dry-goods warehouse. Since then it has been moved six times and now is back in its original commercial activity, but in an up-town establishment. Its wanderings though have taken it to a fish mongers stall, a cafe, a retail shop, a paper warehouse and a private dwelling, yet in all that time there has never been a complaint against its findings. In the last ten years it has ticked off some 2,200 kilowatt-hours, and now in its Eighteenth Street location it is working with the same accuracy it has shown under every test to which it has been subjected.

Although No. 1 is the oldest meter in the service of the company it was not the first meter installed, for before the days of the mechanical meters, of which No. 1 is a type, the old chemical meters were used, and three were installed by Edison himself, in the first days of central-station service. At about the time No. 1 went to his present post, his brother, No. 157,832 was just entering his central-station career.

Electrification of Another English Railway Line.

The North Eastern Railway Company has decided to electrify its mineral line between Shildon and Newport, near Middlesborough, England. This distance is 18 miles.

St. Louis Jovian League Have Good Program for March.

The following program has been announced for the March meetings of the St. Louis League of Electrical Interests, Jovian Chapter:

Richard McCulloch, vice-president and assistant general manager, United Railways Company of St. Louis, presented a paper on March 4 on "Electric Railway Problems."

George McD. Jones, superintendent Fire Alarm Telegraph System, City of St. Louis, on March 11, 1913, "New Developments in Fire Alarm Telegraph Systems."

Fred Adams, vice-president and general manager, Frank Adam Electric Company, on March 18, "The Relation of the Electrical Interests to the Architect." At this meeting the architects of St. Louis will be the guests of the league.

Henry H. Humphrey, consulting engineer, on March 25, "The Use of Electricity in the Largest Office Building in the World."

Data on Underground Systems to Be Compiled.

As was announced briefly in last week's issue, the National Electric Light Association has been in receipt of quite a number of communications recently from member companies, requesting information with regard to the extent to which underground work has been carried on in this country. From time to time the attempt has been made to compile statistics regarding the underground situation, such as the number and population of cities having such systems, the extent of the service, etc. Some few years ago the Association compiled data of this kind from its members and for them, but these figures have become obsolete and the company membership of the Association now includes hundreds of cities from which no information at all was obtainable at the time previous statistics were compiled. Application to the manufacturers of underground conduit for definite information on these points has not resulted in comprehensive enough information being obtained.

It is now announced that G. M. Gest, the eminent engineer and contractor, who has made a specialty of conduit work, will undertake, on behalf of the Association, to make a canvass not only of the members of the Association, but of every place in the country where a central-station service exists as to the extent and characteristics of the underground system installed. The inquiry will be simple in its nature as to the facts sought to be brought out, and it is believed that every plant can furnish the information if it has any circuits under ground.

Mr. Gest has prepared a simple form of card inquiry suitable for direct return to his office, asking the following questions:

Have you any conduit installed?
About how many duct feet?
Have the telephone companies any?
About how many duct feet?
Have the telegraph Companies any?
About how many duct feet?
Have the traction companies any?
About how many duct feet?
Does the city own any conduit system?
About how many duct feet?
Have you an ornamental lighting system?
About how many posts?

When the information is collected Mr. Gest will turn it all over to the Association, where it will be available for perpetual reference. Returns are to be made to G. M. Gest, 277 Broadway, New York.

Coal Supplies of the World.

In a British Board of Trade report just published statistics are given relating to the production, consumption, and imports and exports of coal in the British Empire and the principal foreign countries.

It states that the total known coal production of the world (exclusive of brown coal or lignite) in 1911 was about 1,050,000,000 tons, of which the United Kingdom produced more than one-fourth and the United States more than two-fifths. As compared with population the production in the United Kingdom surpasses that in the United States, the amount being 6 tons per head, as against under 5 tons per head. The output in the five principal coal-producing countries in 1911 was as follows: United Kingdom, 271,899,000 tons; Germany, 158,164,000; France, 38,023,000; Belgium, 22,683,000; and the United States, 443,025,000. In the United Kingdom, Germany, and France the production in 1911 exceeded that of any previous year. The average value per ton of the coal taken at the collieries in 1911 was: United Kingdom, $1.982; Germany, $2,375; Belgium, $2.92; United States, $1.432.

Homer Niesz to Address Chicago Jovians.

At the regular weekly noon-day meeting of the Jovian Lunch Club of Chicago to be held at the Grand Pacific Hotel, March 10, Homer E. Niesz, manager of the Cosmopolitan Electric Company, Chicago, will be the principal speaker. The lunch club features a one-hour meeting. Plans are under way for a rejuvenation on the evening of Tuesday, April 15.

New Electrical and Mechanical Appliances

New Austin Standards for Ornamental Tungsten Street Lighting.

As a result of extensive experience in manufacturing and installing ornamental standards for street lighting by means of tungsten clusters, the designing department of M. B. Austin & Company, Chicago, Ill., has developed a new line of convertible units, a few of which are illustrated herewith. They are of substantial cast-iron construction. The lines of the design are graceful and well proportioned. The base is 18 inches square; there is ample room therein for location of a cutout or switch, for which purpose a locked door is provided in one face. The shaft is tall and slender, thus avoiding the cumbersome and view-obstructing aspect sometimes seen.

One, Three and Five-Lamp Austin Standards.

The construction is such that two or four arms may be used and these may be fastened so that the lamps are upright or inverted. The upper middle globe is 14 inches in diameter and the globes on the arms are 12 inches in diameter. In residence districts, parks or less frequented boulevards the side arms and lamps may be left off entirely, making very neat single-unit standards. As the traffic or importance of the thoroughfare increases, two side arms may be added and ultimately the third and fourth. Thus the same general design is adapted to all the streets in the community, producing a very harmonious and pleasing effect. The total weight of the five-lamp standard is 675 pounds.

The Brascolite Semi-Indirect Luminous Unit.

The principle of illumination in the Brascolite unit is semi-indirect, or, in other words, all direct light rays are diffused and the indirect rays are reflected from a ceiling reflecting plate. This unit is constructed practically entirely of glass. The canopy or reflector is made of dense white opal glass depolished on the outside. The bowl suspended below same is made of Alba glass which has excellent diffusing qualities and very little absorption. A tripod in the reflector for attachment to ceiling outlet is of cast malleable iron to which is attached a porcelain flexible-tongue center-contact Bryant socket. The loops below the reflector are of cast brass and screwed into the tripod, thereby carrying the bowl independent of the reflector. The three aluminum chains have hooks on the lower end so that any one can be easily unhooked, the bowl allowed to hang on the other two for cleaning and replacing the lamp. The special tripod makes it possible to install the unit to a spud, or to the side holes in the standard four-inch junction box, or to use wood screws. Insulating joints or canopy insulators are never required as the building wires are connected directly to the brass terminals of the socket, and the reflector, being of glass, is a nonconductor. The socket is placed high in the reflector to obscure the skirt of the lamp.

The unit is made in four sizes: For 60 or 100-watt lamp, 12-inch diameter reflector; for 150-watt lamp, 14-inch diameter reflector; for 250-watt lamp, 18-inch diameter reflector; for 400 or 500-watt lamp, 22-inch diameter reflector.

The efficiency is claimed to be better than any lighting unit on the market. A photometric test made in a typical office room with the 150-watt unit indicated 3.5 average foot-candles on a plane thirty inches above the floor. For high ceilings the unit should be dropped from the ceiling to about nine feet above the floor (depending upon the size of the unit and distance between the outlets).

Brascolite Luminous Unit.

The fixture is non-corrosive, and will retain its efficiency indefinitely. It is suitable in office buildings, schools, salesrooms, hotels, etc., in fact, wherever good general illumination of high efficiency is necessary.

The Brascolite unit is manufactured by the Luminous Unit Company, 2615 Washington Avenue, St. Louis, Mo., the St. Louis Brass Manufacturing Company, also of St. Louis, being distributors.

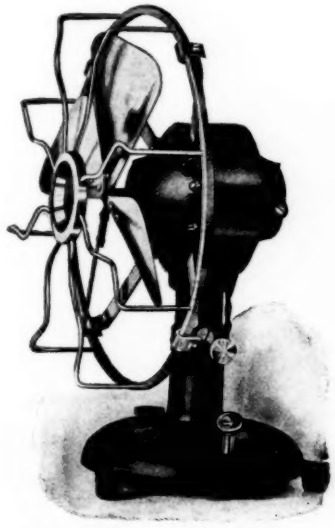
Menominee Electric Fans.

For this year's trade the Menominee Electric Manufacturing Company, of Menominee, Mich., has improved its line of electric fans, incorporating therein its most recent developments gained from 20 years of electrical manufacture. Its distinctively direct-current fans are now confined to two types, the eight-inch, ten-volt battery fan with trunnion base and the standard 110-volt swivel and trunnion fans. The latter are made in three sizes, 9, 12 and 16 inches. They have three speeds ranging from 1,400 to 2,000 revolutions per minute. If desired, these fans can also be wound for 220 volts.

Combination fans that operate equally well on direct-current or 60-cycle alternating-current circuits are made in several forms and sizes. The armature and fields are laminated and three speeds can be had on either current. The stationary fan is an eight-inch fan of the trunnion type. The oscillating fans are made in 8, 12 and 16-inch sizes and can be operated either as desk or bracket fans. The operating mechanism is of the worm-gear type and is mounted in a gear case at the rear of the fan. This mechanism is thoroughly lubricated and runs with little power and no noise.

A unique type of fan that runs on either direct current or alternating current, is the Menominee table fan with an eight-inch sweep. This is particularly serviceable for dining table and restaurant use and gives a good diffusion of air through a space more than ten feet in diameter. Three speeds, ranging from 1,300 to 1,900 revolutions per minute, are available.

A 12-inch commutator type of alternating fan with swivel and trunnion construction and three speeds, is made so that it can be changed from a desk to a bracket fan in a few moments without using extra parts. The commutator has 36 segments. Induction-motor fans of very simple construction are made in 12-inch and 16-inch sizes, each having three speeds. These are also made as oscillating fans with the same type mechanism as the commutator fans.



Menominee Eight-Inch Combination Fan.

Menominee Table Fan.

Westinghouse Ozonizer.

The use of ozone as a purifying agent has become a well established custom, its fields of application being in offices, clubs, school rooms, churches, theaters, dwellings and similar places. Ozone is also found to be a preservative agent against mold and putrefaction in foods, and in pulmonary diseases gives relief and sometimes effects a cure. The ozone oxidizes the various animal and vegetable substances which it attacks and renders them odorless.

The Westinghouse Electric & Manufacturing Company has just placed a new ozonizer on the market. One of these machines will generally produce sufficient ozone to purify the air in a room having an area of 40 square feet and the average height. The Westinghouse ozonizer consists of a step-up transformer, tubes for generating the ozone, and a regulating switch, all contained in an easily portable case. The function of the transformer is to raise the voltage of the standard 110-volt supply circuit to that required by the ozone-generating tubes.

These tubes are of glass of special construction, having an outer coating of metal made to adhere closely to the glass by a special process. The inner walls of the tubes are lined with a metal mesh which forms the ozone-generating surface. The outer coating is connected to one terminal of the high-tension winding of the transformer, and the inner coating is connected to the other terminal. The uneven distribution of potential by the metal mesh on the inside of the tubes produces a large number of tiny brush discharges which generate ozone.

The generating cylinders are located above the transformer and stand vertically, so that the warm air rising from the transformer and from the inside of the generating tubes causes an upward draft, drawing in fresh air at the bottom and giving off a uniform flow of ozonized air at the top.

On top of the case is a knurled knob connected to the regulating switch located inside the case, which is connected to the generating tubes in such a manner that, by turning the knob to the positions indicated on the dial, the number of tubes in operation may be regulated from one to four, with a corresponding change in the output of ozone.

The cylindrical part of the case is of heavy sheet metal and the top and bottom of wood. This wood is thoroughly seasoned and heavy enough to prevent warping. The ozonizer is furnished with either one of two kinds of finish. One is white enamel all over, which is intended for hospitals and dispensaries. The other finish is polished mahogany for the wooden top and bottom and dull black for the remainder of the case.

Westinghouse Ozonizer.

The ozonizer is designed for connection direct to the lamp socket, as it only takes 18 watts at maximum production. The operation is practically noiseless, so that it can be left running in the sleeping room without the slightest disturbance. Although the voltage is stepped to a high value, the circuits are so thoroughly insulated, and all exposed metal parts are electrically connected together, so that no difference of potential can exist between them even though a part of the circuit should become grounded on the case.

Attachment for Converting Any Inclosed Arc Into a Flaming Arc.

Despite the fact that the inclosed arc lamp is now generally conceded to be obsolete, thousands of these lamps still remain in service, giving results which up to a few years ago would have been regarded as quite satisfactory. The reluctance shown by many users toward the replacement of these lamps by more efficient units is due largely to the considerable investment they represent. From this has arisen a demand for means by which these lamps can be converted to high-efficiency units.

An ingenious attachment for changing inclosed arcs into flaming arcs has been placed on the market under the

Superior Flaming Arc Attachment, Showing Inner Globe Lowered.

name Superior flaming arc attachment. It is said that it can be applied to any type of inclosed arc lamp, regardless of voltage and whether the lamp is used in series or multiple or direct-current or alternating-current circuits. The accompanying illustration shows a lamp with the new attachment, the inner globe being lowered to show the arrangement better.

The only thing removed from the old lamp is the globe and lower carbon-holder, so that the gas check is exposed. The top plate of the attachment is then drilled to suit the attaching screws and fastened to the lamp. The body of the attachment is then slipped into the holes provided in the plate. The negative wire is secured in the binding-post on the attachment. In direct-current lamps the customary polarity is reversed so that the lower electrode is positive. The lamp is then ready for service.

An ordinary carbon such as is used for inclosed arcs, but 15 inches long, is employed for the upper electrode. A short, thick electrode is used below; it alone is impregnated, yellow or white-flame salts being used. Since the mechanism of the lamp is not changed, its watt consumption remains unaltered. The efficiency of the lamp is said to be the same, or better, than that of standard flaming arc lamps using the same voltage and current.

The inner globe is of clear glass and is enlarged on top so as to form the base of the large condensing chamber to which it is secured by flexible phosphor-bronze springs. The arrangement is such that the fumes cool and deposit in this chamber, which is easily wiped clean during trimming, when the inner globe is lowered as shown. An opal outer globe is supplied, when desired.

This attachment has been developed and placed on the market by the Dyer Flaming Arc Company, 225 North Tenth Street, Philadelphia, Pa.

Preservative Treatment of Timbers for Panama Lock Fenders.

Timber for the fenders in the approaches to the locks in the Panama Canal will be treated with preservatives before it is installed. In all 551,312 board feet, in sticks 12 by 16 inches and 16 feet long, will be required, and the first shipments have already been made. Originally it was the intention to use oak for this purpose, but the cost of both oak and yellow pine was so great that bids were asked including Douglas fir. This wood has been selected at a price of $34.30 a thousand board feet.

The climate and insects in Panama are very destructive to wood. As preservative against these attacks, the fender timbers will be treated with Avenarius Carbolineum, a liquid compound of oily nature. A tank 4 feet square in cross section and 20 feet long has been erected at Miraflores for this purpose. Within the tank is a coil through which hot steam will be circulated, bringing the liquid up to a temperature of 190 degrees Fahrenheit. The timbers will be immersed in this hot liquid, nine at a time, and allowed to remain in it 30 minutes. It is estimated that from 72 to 81 timbers can be treated in a day of eight hours.

The Carbolineum Wood Preserving Company, of Milwaukee, Wis., is the sole importer of Avenarius Carbolineum in the United States.

National Lever-Type Hand Shear for Metal Molding.

The National lever-type hand shear has been added to the line of products o. the National Metal Molding Company, Pittsburgh, Pa., to meet a constantly growing demand for some form of tool which could be used for cutting the base and capping of National metal molding. It is arranged to shear the base and capping separately, not assembled, the die block being provided with separate grooves for each, as shown in the cut herewith.

The shear is shipped assembled on an oak base complete with handle, as

Hand Shear for Metal Molding.

shown. The knives and die block are of hardened steel and ensure long life and satisfaction if the tool is used with reasonable care and the moving parts are kept well oiled. It will be found a great labor and time saver on any save small jobs, particularly for cutting and capping on jobs where large numbers of National fittings are being used with which it is not necessary to cut the base, as with the No. 356 receptacles.

Government Power Plant Proposed in Australia.

Among the big schemes proposed by the officers of the Public Works Department, New South Wales, is a project for generating electricity at one of the coal fields in the southern part of the state, and supply of the current to the populated areas not at present served by the Sydney City Council; establishment of electrothermic and electrolytic industries, such as the manufacture of calcium carbide and cyanamide, and of caustic soda, are also included in the scheme. At present the Government has a timber depot, abattoirs, and brickworks in the vicinity of Uhr's Point, and the Public Works Committee will be asked to consider the question of spending $250,000 on an electric generating plant there to supply power to the State enterprises.

It is reckoned that the demand for electric power by the State enterprises, and by the municipalities and private enterprises in the southern area, will be so great that it will be imperative for the Government to take the matter in hand. The scheme referred to above provides for the utilization jointly of the State coal and water-power resources by the establishment of power stations in each of the important coal fields, and on those rivers which may be depended upon to provide sufficient power.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

HERMAN, MINN.—This town is agitating the installation of an electric-light system.

MILLARDVILLE, B. C. — The Western Canada Power Company will install power lines here at once. O.

ORTING, UTAH.—Plans and estimates are being prepared for the establishment of a municipal light and water plant.

CLE ELUM, WASH.—The Kittitas Railway & Power Company will construct a waterpower plant near Salmon LaSac. O.

OGDENSBURG, N. Y.—A bill is at present pending to authorize this town to build a municipally owned lighting plant.

HAWKEYE, IOWA.—A franchise has been granted to C. Miller & Sons for furnishing electric light and power to this city.

NEWARK, N. J.—The Public Service Corporation will make alterations and extensions in its electric substation on the Plank Road. A.

ORTING, WASH.—This city is receiving estimates and formulating plans for the establishment of a municipal light and power plant. O.

BAKERSFIELD, CAL.—The Southern Sierra Power Company has been granted a 50-year franchise for an electric pole, tower and wire system in Kern County.

HALLETTSVILLE, TEX. — The City Council will install additional machinery and equipment in the municipal electric light and waterworks plant.

EPHRATA, WASH.—This city contemplates the establishment of a municipally owned electric light plant. The plans will be based on a thoroughly equipped plant.

CANTON, KANS.—The city officials are advertising for bids for an electric-lighting plant to be built this spring. Bonds for a plant were voted over two years ago.

LOUISVILLE, KY.—R. E. Wathen & Company will require a one-ton electric elevator for a large warehouse, the construction of which will be begun shortly. G.

ELBERTON, WASH.—The Washington Water Power Company will connect this city with the main power line east of here. Work of construction will start immediately. O.

NEW WESTMINSTER, B. C.—The Westminster Power Company, Limited, will construct a hydro-electric plant near here. Plans have been filed in the government offices. O.

SOMERSET, KY.—The United Water, Light & Traction Company has announced that it will commence work shortly upon the erection and equipment of a new power plant of considerable size. Frank Barker and L. J. Holderman are in charge of the plans.

MARTINSVILLE, IND.—The Mitchel Brothers have been granted a franchise by the City Council and will install an electric light and power plant, and also a hot-water and steam-heating system.

BAKERSFIELD, CAL.—The Pacific Light & Power Company has been granted a 50-year franchise to maintain electric transmission wires across certain public highways in Kern County.

ST. JOHNS, ARIZ.—The Little Colorado Light & Power Company has been granted a franchise to construct distributing lines along certain public highways of Apache County, and streets of this city.

TACOMA, WASH.—Commissioner of Light & Water, Nicholas Lawson, recommends that cluster lights be installed in the business districts here to replace globes not used in connection with arc lights. O.

BURLINGTON, N. C.—Piedmont Electric Company, of this city, will construct a plant for furnishing electric light and power, estimated to cost $400,000. Electricity will be transmitted to several towns.

ELSINORE, CAL.—F. A. Worthley, district manager of the Southern Sierra Power Company, estimates that the company will spend $10,000 for improvements and extensions in this city if a franchise can be secured.

SAN FRANCISCO, CAL.—The Chemical Electric Light & Power Company has been incorporated here with a capital stock of $1,000,000, by T. L. Groon, C. H. Hogg, J. B. McKenzie, L. A. Boyer and E. M. Hogg.

WINNEMUCCA, NEV.—Articles of incorporation have been filed for the Nenzel Electric Company, which is to furnish light and power to the new camp of Rochester. The company is to begin work at once on a large power plant at Oreana.

BREMERTON, WASH.—The Northwest Gas, Electric & Waterworks Company has been granted a 25-year franchise to construct and operate a plant in this city. A $75,000 improvement is planned, and work is to begin immediately. O.

ROSEBURG, ORE.—A. Welch, owner of the local light and water system, announces that $30,000 will be spent in Roseburg and vicinity this year on extensions and improvements. A contract has been secured for furnishing water and light to the city of Oakland.

JOHNSTOWN, PA.—Charters have been granted to the Fairview Light, Heat & Power Company and the Rockingham Light, Heat & Power Company, each with a capital stock of $5,000 and for the purpose of engaging in business in this vicinity.

SPRINGFIELD, W. VA.—Magnolia Power Company has been incorporated with a capital stock of $100,000. The incorporators are Peter J. Seaver, Cyril B. Geare, Albert M. Diehl, William E. Walsh and F. Ernest Brackett, all of Cumberland, Md.

PORTLAND, ORE.—The Oregon Electric Railway Company will begin work at once of harnessing the McKenzie River for the development of approximately 50,000 horsepower. The company will also add 43 modern passenger cars to its equipment. O.

SPOKANE, WASH.—The Des Chutes Power Company has been incorporated with a capital stock of $30,000. The officers of the company are Samuel Galland, president; W. C. Sivyer, vice-president; Burt L. Sivyer, secretary-treasurer, and L. M. Simpson, general manager.

CLOVERDALE, CAL.—The California Light & Telephone Company will shortly take over the Cloverdale Light & Power Company's franchise and equipment, together with the contract the local company holds with the Snow Mountain Company for furnishing the current.

BROOKSVILLE, O.—The Public Service Commission has approved the issue of stock of $10,000 for the Brooksville & Lewisburg Lighting Company, the proceeds to be used for the construction of an extension of the electric-light service to this place.

SOMERVILLE, N. J.—The Board of Public Utility Commissioners has granted the Morris & Somerset Electric Company authority for a bond issue of $50,000, to be used for extensions in its electric plant and system.

FRESNO, CAL.—The Pacific Light & Power Company has asked the Supervisors of Fresno County to put up for sale 50-year electric power transmission and telephone franchises from the power plant at Big Creek across the county to the boundary line of Tulare County, south of Reedley.

SPOKANE, WASH.—It is reported that the Chicago, Milwaukee & St. Paul Railway Co. plans to purchase the Washington Water Power Company and use the four plants to furnish power for the electrification of the Milwaukee main line between Avery, Idaho, and the Columbia River. O.

ALEXANDRIA, IND.—Articles of incorporation have been filed by the Indiana General Service Company. The capital stock is placed at $1,000,000. It is the purpose to merge Elwood Electric Light Company, the Alexandria and other small concerns with this company. The directors of the new company are H. F. Finley, F. P. Hunter and M. B. Smith. S.

LEXINGTON, KY.—It is reported that the Kentucky Utilities Company is to undertake the construction of a water power plant at Cumberland Falls, Whitley County. It is also stated that the Kentucky Utilities Company will enlarge its plant at Shelbyville, to enable service to be furnished to Pleasureville, where it recently secured a franchise. G.

DOVER, N. J.—The Board of Water

Commissioners has been authorized by the City Council to enter into contract with the Dover, Rockaway & Port Oram Gas Company for the installation of a pumping plant at a cost of $6,000, and power for operation for a period of ten years.

YUMA, ARIZ.—Frank Brooks, city engineer, has prepared plans for a new municipal waterworks system, a sewer system, electric light and power plant, and street improvements, the aggregate cost of which is estimated at $300,000. The City Council will submit the proposition of issuing bonds for these improvements to a vote of the taxpayers. D.

OLYMPIA, WASH.—Governor Lister and a special Legislative Committee which recently investigated the Celilo Rapids Power project has recommended that the State of Washington appropriate $15,000 to assist Oregon in an engineering investigation to determine whether the development of the project should be undertaken by the two states. The United States Government will be asked to appropriate $50,000. O.

WALNUT RIDGE, ARK.—The Public Service Utility Corporation of Delaware has purchased a large block of stock in the Walnut Ridge & Hoxie Light, Power & Transit Company. It is the intention to greatly enlarge the Walnut Ridge plant and take over the lighting plants at Black Rock and Pocahontas and furnish the power for these towns from Walnut Ridge. A waterworks plant for Walnut Ridge and Hoxie and an interurban line to Pocahontas are the possibilities of the future.

POCATELLO, IDAHO.—J. D. Browning, of the Martineau-Browning Syndicate, which proposes to install a 5,000-horsepower hydroelectric plant on the Port Neuf River at Lava Springs to furnish current for light and power to Pocatello, Downie, Bancroft, McCammon and other towns in this vicinity, announces that work of construction will be started at once. The City Council of Pocatello has granted the firm franchises for an electric-light system and for an electric street railway.

DALLAS, TEX.—Sealed proposals in duplicate will be received by John M. Murch, county auditor, Galveston, Tex., until March 11 for installing an ornamental lighting system on Galveston Sea Wall Boulevard consisting of 57 ornamental five-lamp incandescent posts and eight ornamental arc-lamp posts, together with all cables, lamps and other material necessary to make the installation complete and ready for use. Plans and specifications may be obtained from the county auditor and a certified check on a Galveston Bank for $500 must accompany each bid.

GAINESVILLE, FLA.—Sealed proposals will be received by the Board of Public Works of this city until March 17 at the offices of H. E. Taylor, chairman, for furnishing all material, machinery, equipment and labor for the construction of an electric-lighting system and improvements to the waterworks system. Specifications may be obtained from the engineers, or Mr. Taylor. Copies of plans may be had upon payment of $10. Bids must be furnished on blanks furnished for the purpose and accompanied by certified check for five per cent of amount of bid.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

HARRISBURG, PA.—Weedville & Kersey Telephone Company has been incorporated with a capital stock of $5,000.

DOERING, WIS.—The Doering Telephone Company has been organized by Paul Krueger, Frank Doering and Will Doering.

OLALLA, WASH.—Olalla Telephone Company has been incorporated with a capital stock of $10,000 by John Karcher, H. F. Hall and others.

LANSING, MICH.—The Greenwood Mutual Telephone Company has been incorporated with a capital stock of $1,000 for the purpose of operating a telephone system.

NIOTA, TENN.—Niota Telephone Company has been incorporated with a capital stock of $5,000 by H. M. Wilson, Gus Eckel, J. M. Slack, J. D. Turner and W. N. Riggle.

UNION, KY.—Mutual Telephone Company has been incorporated with a capital stock of $6,000. The incorporators are R. R. Houston, Noah Zimmermann, Ezra Tanner and W. H. Rice.

DANVILLE KY.—A new telephone company has been organized here to build a telephone line to Butchertown, thence to Gravel Switch, where it will be connected with the independent line.

TAMPA, FLA.—Peninsular Telephone Company has increased its capital stock to $1,000,000 and will place 1,000 additional cable lines, and erect and equip a telephone exchange at this place.

LEWISTON, IDAHO.—About 2 miles of cable will be installed in Lewiston and 2 miles in Clarkston, according to statements made by Manager Johnson of the Pacific Telephone Company. O.

BELLINGHAM, WASH. — The Farmers Mutual Telephone Company plans improvements to the system between this city and Sumas, Wash. A central station will be built at Sumas. H. E. Stewart is secretary of the company. O.

ANDOVER, ILL.—The Andover Mutual Telephone Company has been incorporated with a capital stock of $2,500 to operate a mutual telephone system. Nathan H. Anderson, George H. Johnson and Henry L. Larson are the incorporators.

PARIS, ARK.—The Logan County Telephone Company of Scranton has been incorporated with a capital stock of $100,000 by H. Webb, Roseville, Dr. Earl Hunt, Clarksville, and James R. Gronds, Paris. The company will maintain office in this place.

ROCKAWAY, N. J.—The Borough Council has voted to authorize the New York Telephone Company to install and maintain a fire-alarm system through the borough in return for the granting of liberal franchises, in accordance with offers formerly tendered by the company. A.

SAN ANTONIO, TEX.—The Brazos Valley Telegraph & Telephone Company, which has its general offices at Waco, has purchased the telephone exchange and system of the San Antonio Telephone Company. It is stated that extensive improvements will be made, including a long-distance line.

ELECTRIC RAILWAYS.

(Special Correspondence.)

EVERETT, WASH.—The Great Northern Railway Company, which plans interurban service from Monroe to Tolt, will build a substation on Colby Avenue here.

RIVIERA, TEX.—The Riviera Beach Interurban Railway Company is preparing to construct an extension of its line from Riviera to Falfurrias, a distance of about 15 miles. D.

TRENTON, N. J.—The Trenton & Mercer County Traction Company is planning for the reconstruction of its system on North and South Broad Streets, and on Center Street.

WHEELING, W. VA.—Representatives of the West Penn interests have promised that a trolley line to connect Pittsburgh and Wheeling by way of Washington, Pa., will be built.

LOS ANGELES, CAL.—Southern Power Company has been incorporated with a capital stock of $600,000. The directors are E. C. Richardson, C. M. Melich, E. V. Fisher, M. B. Simmons, E. A. Merrill, J. E. Nishl and L. N. Inskeep.

SOUTH VANCOUVER, B. C.—The British Columbia Electric Company plans for the construction of an extension to the Davie street car system from Twenty-fifth Avenue to the Fraser River Valley. Work will begin immediately.

PORTLAND, ORE.—The Portland Railway Light & Power Company has been granted a franchise for the construction of 18 miles of street railway lines in this city. Work will be started at once. Approximately $300,000 will be expended.

ASOTIN, WASH.—F. L. Sturn of Lewiston, Idaho, who was recently granted a franchise to build an electric line between this city and Clarkston, states work of constructing 10 miles of the proposed line will begin at once. The estimated cost is $300,000.

GALLATIN, TENN.—Immediately upon the completion and operation of the Nashville-Gallatin interurban a 50-mile extension north will be agitated. A subscription of $200,000 to the capital stock of the company will be asked of the citizens along the proposed route.

MATAMOROS, MEX.—A. B. Cole and B. B. Rentfro, of Brownsville, have been granted a 50-year franchise for the installation and operation of an electric street railway system in Matamoros. They also contemplate installing a waterworks plant and the construction of a distributing system here. D.

VICTORIA, B. C.—The interests of the Couteau Power Company have been taken over by the Canadian-Northern Railway Company, and latter named company will utilize the power plants to electrify the branch line of the road into the Okanogan country. The company plans expending $2,000,000.

TOLEDO, O.—Surveyors are laying out a route for the Toledo, Ottawa, Ottawa Beach & Northern Electric railroad from its present terminus through to Detroit. The road will be built and put in operation as far as Monroe this summer, and later will be built to Detroit.

MORRISTOWN, N. J.—The Morris County Traction Company has been granted permission by the Board of Public Utility Commissioners to issue

bonds to the extent of $4,179,000 and stock for $300,000, to provide for exchanges and renewals in present outstanding issues, and for extensions and improvements in its system. A.

CLEBURNE, TEX.—A committee of local citizens headed by S. M. Braswell has been appointed to assist E. P. Turner of Dallas in promoting the construction of an interurban electric railway between Dallas and Glen Rose via Cleburne. Plans for carrying out this project are said to be well advanced. D.

MARTINEZ, CAL.—The Board of Supervisors has granted the San Ramon Valley Railroad Company a subsidiary of the Oakland & Antioch Company, a permit to construct an electric railroad from Walnut Creek to Danville, and from Danville to the Alameda County line, through Green, Sycamore and San Ramon Valleys.

DENTON, TEX.—E. P. Turner and associates have been granted a 50-year franchise by the Commissioners Court for an interurban electric railway, which they propose constructing through the county from north to south. The proposed line will pass through the towns of Lewisville, Denton and Sanger in this county, and will run between Dallas and Gainesville. D.

ALEXANDRIA, LA.—The Southern Traction & Power Company has taken over the electric street railway system and other holdings of the Alexandria Electric Street Railway Company. The new company, which has a capital stock of $200,000, will extend the line and make important improvements to the property. William P. Jenkins is president. D.

WINDSOR, ONT.—It is authoritatively stated that the Ontario Hydro-Electric Commission has plans to build electric railways along the routes of transmission lines and operate them with Niagara power. It is the intention to operate an electric railway and transmission line between London and Windsor direct, a distance of about 115 miles.

NEW ALBANY, IND.—McPherson Sheppard, of Boston, Mass., representing Pittsburgh public service capitalists, is said to be in possession of plans for the construction of an electric railway from New Albany, directly across the river from Louisville, Ky., and in direct connection with Indianapolis, Ind., to French Lick Springs, a famous health resort. G.

LAPORTE, IND.—The Laporte, Logansport & Southern Railway Company has been incorporated with a capital stock of $100,000 to operate a street railway and interurban between Laporte and Logansport. The directors are Warren W. Travis, Phineas O. Small, Arthur G. Tamlin, Riley F. Small, Carl J. Loetz, Ralph N. Smith and Ora Bosserman.

RED BLUFF, CAL.—E. L. Sisson, secretary of the Sacramento Valley Electric Railroad Company, says that his company expects to begin construction August 1, and hopes to have cars running into San Francisco over the Oakland and Antioch system within the year following. The project contemplates the building of an electric line from Red Bluff to connect with the Oakland and Antioch several miles west of Sacramento. This section will be 160 miles in length. It is the plan to build ultimately to Eureka, 160 miles more.

PROPOSALS.

ELECTRICAL WIRE.—Sealed proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 25 for furnishing various kinds of cable in miscellaneous quantities to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5246.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until March 28 for the installation complete of an electric passenger elevator in the post office and courthouse at Charleston, W. Va., in accordance with drawing and specification, copies of which may be obtained from the Supervising Architect.

GENERATOR SET.—Sealed proposals indorsed "Proposals for Generating Set" will be received at the Bureau of Yards and Docks, Washington, D. C., until March 22 for furnishing a three-wire, direct-current, engine-driven, 125-kilowatt generator set at the United States naval hospital at Norfolk, Va. Amount available $5,200. Plans and specifications may be obtained by application either to the Bureau or the commandant of the Norfolk Navy Yard.

ELECTRICAL FITTINGS.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 18, for furnishing miscellaneous snap switches and porcelain plugs, to be delivered at the Navy Yard, Brooklyn, N. Y., as per Schedule 5216; 6,000 pounds cast-steel galvanized wire, to be delivered at the Navy Yard, Boston, Mass., as per Schedule 5219; 4,500 pounds solder, half-and-half, to be delivered at the Navy Yard, Norfolk, Va., as per Schedule 5220; and until March 25 for furnishing the annual supply of dry cells at various navy yards, as per Schedule 5227.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until April 3 for furnishing the electric conduit and wiring and interior lighting fixtures of the new building for the Bureau of Engraving and Printing, Washington, D. C.; until April 7 of a one-story building for the post office at Casper, Wyo.; until April 8 of a two-story building for the post office at Lawrenceburg, Ky.; until April 11 of a one-story building for the post office at Boonville, Mo.; and until May 2 of a two-story building for the post office at South Chicago, Ill. Plans and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until April 12 for the electric conduit and wiring and interior lighting fixtures of a two-story building for the post office at Douglas, Wyo.; until April 21 of a one-story building for the post office at Harrisburg, Ill.; until April 22 of a one-story building for the post office at Le Mars, Iowa; until April 26 of a one-story building for the post office at Oxford, N. C.; until April 28 of a two-story building for the United States Appraisers' Stores, Milwaukee, Wis.; until April 29 of a one-story building for the post office at Covington, Va.; and until May 1, of a one-story building for the post office at Petosky, Mich. Drawings and specifications may be obtained from the custodians of the various sites or from the office of the Supervising Architect at Washington, D. C.

NEW INCORPORATIONS.

SEATTLE, WASH.—Aladdin Lamp & Electric Company has been incorporated with a capital stock of $12,000 by J. J. Horsfall, Robert Waddell, and others.

LOUISVILLE, KY.—Articles of incorporation have been filed by the F. F. Valinoti Company, to deal in electrical supplies. The company is capitalized at $600 and was incorporated by F. F. Valinoti, Emily H. Valinoti and E. B. Howe. G.

NEW YORK, N. Y. — No-Shock Wheel Company, Incorporated, has been granted a charter with a capitalization of $400,000. The incorporators are J. W. Ebba, Englewood Cliffs, N. J.; R. H. Waddell, New York, N. Y.; and A. A. Kelley, Montclair, N. J.

CHICAGO, ILL.—Hurley Electric Tool Company has been incorporated with a capital stock of $5,000 for the purpose of manufacturing and dealing in electric tools, machinery, etc. The incorporators are Neil C. Hurley, L. R. Brigham and Walter T. Haynie.

CLEVELAND, O.—The Berg-Clark Electric Company has been incorporated with a capital stock of $5,000 to do a general electrical construction business. The incorporators are Conrad Berg, William E. Clark, F. B. Evarts, W. S. Mitchell and C. Verbsky.

FABIUS, N. Y.—Static Electro-Eradicator, Incorporated, has been incorporated with a capital stock of $25,000 to manufacture appliances for eradication of static electricity from machines. The incorporators are E. L. Vezina, A. H. Smith and H. S. Palmer, all of Syracuse, N. Y.

NEW YORK, N. Y.—The Woodruff Manufacturing Company, Incorporated, has been granted a charter with a capitalization of $15,000, to install electrical devices, electric carriage calls, etc. The incorporators are Willard S. Woodruff, Henry Kissinger and Edward F. Gray, all of New York City.

FOSTORIA, O.—The Faultless Anchor Company has been incorporated with a capital stock of $3,000 for the purpose of manufacturing and dealing in Faultless anchors, telephone and telegraph supplies, etc. The incorporators are Clinton Bowen, Robert G. Miller, Grant Masson, Charles M. Richardson and Arthur N. Reed.

LOUISVILLE, KY.—The Louisville Gas & Electric Company, of Delaware, has been incorporated with a capitalization of $18,000,000. The Corporation Trust Company, of New Jersey, attended to the details of the incorporation of the big new company which is expected to become the holding company of the utilities in Louisville, now owned by H. M. Byllesby & Company, of Chicago, as well as of public service corporations which the Byllesby interests expect to acquire in Louisville. G.

FINANCIAL NOTES.

Northern Texas Electric stockholders have voted to authorize an increase in six-per-cent preferred stock from $4,500,000 ($500,000 unissued) to $5,000,000, and common stock from $2,500,000 to $5,000,000.

The Wisconsin Railway, Light & Power Company has sold to N. W. Halsey & Company, New York City, $1,200,000 of first and refunding five-per-cent bonds. The bonds are a first lien on all property now owned or hereafter acquired by the company, which has just been organized to take over several Wisconsin properties.

Chicago Railways earnings from February 1 to September 1, 1912, increased five per cent but during the remaining five months of the fiscal year they increased nine per cent, making average monthly increase for the fiscal year seven to eight per cent. Recent monthly increases have been on an ascending scale without interruption.

By a divided vote the State Board of Public Utilities Commissioners have approved the application of the Morris County Traction Company for an issue of bonds amounting to $4,179,000 and an issue of stock amounting to $300,000. The bond issue is to be secured by a general mortgage for $5,000,000 to be given to the Safe Deposit & Trust Company, of Pittsburgh, as trustee.

At a special meeting, stockholders of the Union Traction Company assented to the proposed issue of $4,200,000 equipment trust securities by the Philadelphia Rapid Transit Company. The action was necessary in order to secure the release of Union Traction's interest in the present equipment, so that it might be transferred in trust as the security for the proposed obligations.

At a special meeting of stockholders of Bell Telephone Company of Canada, directors were authorized to issue from time to time $3,750,000 bonds and debentures. President Sise said that the company did not intend to issue any of the bonds at the present time, the special meeting being held immediately after the annual meeting because it was thought wise to have the authorization of the stockholders to any new financing.

The committee representing the holders of the six-per-cent notes of the Kansas City Railway & Light Company, due September 1, 1912, announces that it has arranged for the payment of the interest on said notes from September 1, 1912, to March 1, 1913, at the New York Trust Company, on and after March 1, 1913, at the rate of seven per cent per annum. Notes or certificates of deposit for notes must be presented for endorsement of the payment of the interest.

The personal property of the Allis-Chalmers Company, a $50,000,000 corporation, was sold at auction on February 27, for $4,000,000, James N. Wallace, John H. McClementy and Francis S. Bangs of New York, representing a reorganization committee, being the only bidders. The sale includes all raw material, storage, accounts, orders, stocks, bonds and securities of all factories, the largest of which are located at Milwaukee, Chicago and Scranton, Pa. The firm passed into the hands of receivers on application of the Continental and Commercial Trust and Savings Bank of Chicago on April 8, 1912. The real estate was sold on February 3, 1913, for $2,250,000. When the court approves of the sale of personal property, a new organization will be formed, with a capitalization of $42,000,000, of which $27,000,000 will be common stock.

Control of the Lincoln (Neb.) Traction Company has passed to the Moore syndicate of Detroit, the stock, which has been held by J. C. Seacrest, J. E. Miller and Charles Stewart, of Lincoln, having been sold to the Detroit interests. Sanford Ladd of Detroit has been elected to the board of directors by the new interests, and J. H. Humpe, who has been general manager of the company for fifteen years, has been succeeded by J. N. Bramlett. The Moore syndicate has rights for a hydroelectric development in Nebraska, which is to be made under the name of the Commonwealth Power Company, and Mr. Bramlett is a representative of that corporation. Lincoln Traction operates 55 miles of street railway, and has $1,101,800 six-per-cent preferred and $1,652,000 common stock outstanding. It has a funded debt of $1,170,000. Gross earnings of the company are around $500,000 a year.

Official announcement is made by the Pacific Gas & Electric Company that, pursuant to a resolution adopted by the directors, a special meeting of the stockholders has been called for April 8 to authorize an increase of $5,000,000 in the company's funded debt, in the form of 10-year six-per-cent debenture bonds. During the fiscal year 1912 there was expended for additions, improvements and betterments $7,900,000. It is expected that during the present year similar expenditures will aggregate fully that amount. Moreover, it is the company's announced intention to continue as vigorously as possible its hydroelectric development on Bear River and to have additional installation of at least 53,000 horsepower in operation and contributing revenue before the expiration of the current year.

At a meeting of the stockholders of the Kings Company Electric Light & Power Company and the Edison Electric Illuminating Company of Brooklyn, held February 24, the following board of directors for both companies was elected for the ensuing year: Frank Bailey, William Berri, Anthony N. Brady, Nicholas F. Brady, Horace C. Du Val, Walton Ferguson, Bernard Gallagher, William V. Hester, Seth L. Keeney, Thomas E. Murray, W. F. Sheehan, James N. Wallace, W. F. Wells. All of the above named gentlemen were re-elected with the exception of W. F. Wells, who is now general manager of both companies and takes the place of W. W. Freeman, who was formerly general manager, vice-president and director of both companies.

Dividends.

Brooklyn Rapid Transit; the regular quarterly dividend of 1.25 per cent, payable April 1 to stock of record March 10.

Chicago Telephone Company; a regular quarterly dividend of two per cent, payable March 31 to stock of record March 29.

Houghton County (Mich.) Traction Company; a semiannual dividend of $3 a share on its preferred stock and a semiannual dividend of $2.50 a share on its common stock, both payable April 1 to stock of record of March 22.

Mackay Companies; the regular quarterly dividends of one per cent on the preferred and 1.25 per cent on the common stocks, payable April 1 to stock of record March 13.

United Gas & Electric Company; a semiannual dividend of three per cent on the preferred stock, payable April 1 to stock of record March 12.

Virginia Railway & Power Company; a semiannual dividend of one and one-half per cent, payable April 10 to stock of record March 20.

Reports of Earnings.

ELECTRIC BOND & SHARE COMPANY.

The Electric Bond & Share Company for the year ended December 31, 1912, reports earnings as follows:

	1912	1911.
Gross income	$1,566,978	$966,257
Expenses and commission	340,321	259,045
Net income	1,226,657	707,211
Preferred dividends	160,932	103,333
Common dividends	225,333	160,000
Surplus	840,391	443,878

METROPOLITAN WEST SIDE ELEVATED.

The Metropolitan West Side Elevated Railway Company reports for the eighteen months ended December 31, 1912, as follows:

Gross	$4,491,994
Expenses	2,106,908
Net	2,391,086
Charges and taxes	1,667,195
Surplus	723,890
Dividends	675,479
Depreciation	25,000
Surplus	23,412

NEW YORK RAILWAYS.

The New York Railways Company reports for six months ended December 31, 1912, as follows:

Gross	$7,067,347
Net after taxes	2,494,482
Other income	225,769
Total income	2,720,251
Interest on underlying bonds	1,349,545
Interest on refunding 4s	325,919
Total interest	1,675,464
Interest on adjustment 5s	689,107
Net income	355,680

Total passengers carried for the six months ended December 31, 1912, 136,744,593.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 3.	Feb. 24.
American Tel. & Tel. (New York)	132½	132
Commonwealth Edison (Chicago)	140	142
Edison Electric Illuminating (Boston)	280	*282
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	51¾	51½
Electric Storage Battery preferred (Philadelphia)	51¾	51½
General Electric (New York)	139	137½
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1½	1¼
Massachusetts Electric common (Boston)	16½	16½
Massachusetts Electric preferred (Boston)	76	*77½
National Carbon common (Chicago)	118	*121
National Carbon preferred (Chicago)	115	*116
New England Telephone (Boston)	153	*157
Philadelphia Electric (Philadelphia)	23⅛	22⅞
Postal Telegraph and Cables common (New York)	81	83
Postal Telegraph and Cables preferred (New York)	65	67
Western Union (New York)	68	67⅛
Westinghouse common (New York)	69	69⅜
Westinghouse preferred (New York)	115	117

*Last price quoted.

TAMPA ELECTRIC COMPANY.

The Tampa (Fla.) Electric Company in its income account for the year ended December 31, 1912, compares as follows:

	1912	1911
Gross earnings	$753,834	$691,322
Operating expenses and taxes	394,629	377,766
Net earnings	359,205	313,556
Interest charges	47,081	47,464
Sinking fund	6,674	11,776
Surplus	305,449	254,315

The construction charges during the year were $88,829.

CUMBERLAND TELEPHONE & TELEGRAPH.

The report of the Cumberland Telephone & Telegraph Company for the year ended December 31, 1912, compares as follows:

	1912	1911
Gross	$7,888,443	$7,372,661
Expenses and taxes	5,863,429	4,898,084
Net	2,025,014	2,474,577
Interest charges, etc.	860,690	182,345
Surplus after charges	*1,164,324	2,292,232
Dividends	886,412	1,574,412
Balance	277,912	717,820

*Equal to 10.51 per cent earned on $11,080,150 capital stock, as compared with 11.65 per cent earned on $19,680,150 stock,

LONDON UNDERGROUND ELECTRIC.

The Underground Electric Railways Company of London, Ltd., reports for the six months ended December 31, 1912, compared as follows:

	1912	1911
Income from investment, operation of power houses, etc.	£279,219	£156,548
General expenses, salary, bond interest, etc.	83,415	102,533
Balance	195,804	54,015
Interest pay on income bonds, plus taxes	195,484	52,333
Surplus	320	1,682

AMERICAN PUBLIC UTILITIES COMPANY.

The American Public Utilities Company, for January, 1913, and the four months ended January 31, 1913, reports earnings as follows:

	1913	1912
January gross	$223,674	$198,379
Net earnings	107,812	91,045
Other income	4,379	.....
Net incomes, less exp.	109,763	.....
Balance after fixed charges and preferred dividends	42,657	.....
Four months' gross	864,515	766,876
Four months' net	436,165	392,266
Other income	11,608	.....
Net income, less expenses	438,782	.....
Balance after fixed charges and preferred dividends	170,360	.....

SHAWINIGAN POWER COMPANY.

The report of the Shawinigan Water & Power Company for the year ended December 31, 1912, shows net earnings of $1,362,257, against $1,189,263 in 1911. The balance available for dividends was $872,360, equal to 7.93 per cent on the capital stock, as compared with 7.52 per cent earned the previous year. The income account compares as follows:

	1912	1911
Gross	$1,569,671	$1,349,715
Expenses	207,414	160,452
Net	$1,362,257	$1,189,263
Interest	489,897	436,750
Balance	$872,360	$752,513
Dividends	540,000	456,250
Surplus	$332,360	$296,263
Reserve fund	189,375	249,637
Surplus	$142,985	$46,626
Previous surplus	9,772	23,146
Total	$152,757	$69,772
Charges and depreciation	128,475	60,000
Profit and loss surplus	$24,282	$9,772

MASSACHUSETTS LIGHTING COMPANIES.

The Massachussets Lighting Companies for January, 1913, and the seven months ended January 31, 1913, report net sales of gas and electricity as follows:

	1913	1912
January	$ 92,352	$ 84,348
Seven months	608,086	546,329

This is an increase of 9.5 per cent in net sales of gas and electric current for January, 1913, over January, 1912, and of 11.3 per cent for the seven months ended January 31, 1913, over the corresponding seven months of the preceding year.

INTERBOROUGH RAPID TRANSIT.

The Interborough Rapid Transit Company reports as follows for January and seven months ended January 31:

	1912	1911
January gross	$ 2,903,344	$ 2,864,136
Net after taxes	1,574,290	1,512,083
Other income	33,926	28,253
Total income	1,608,216	1,540,336
Surplus after charges	682,976	608,840
Seven months' gross	18,640,513	17,685,056
Net after taxes	9,713,645	8,993,255
Other income	239,970	221,049
Total income	9,953,615	9,214,303
Surplus after charges	3,509,947	2,806,742
Passengers carried in January	56,751,506	55,130,117
Passengers carried in seven months	363,664,484	343,614,877

PERSONAL MENTION.

NORMAN E. BOUCHER has been appointed secretary of the Northwestern Cedarmen's Association to fill the vacancy caused by the resignation of the former secretary, H. H. McKinney, who has gone into business for himself.

E. C. BRADLEY, vice-president and general manager of the Pacific States Telephone & Telegraph Company, has resigned. Mr. Bradley has been desirous for some time to retire from active life, having been in the service for 40 years, beginning as a telegraph operator.

C. MONTAGUE, who has been manager of the Bell Telephone Company's office at Parkersburg, W. Va., for the past five years, and manager of the joint office of that company and the Western Union Telegraph Company since last May, has been transferred to the Washington, Pa., office. EDWARD REISER, of Wheeling, W. Va., will succeed Mr. Montague as manager of the joint offices at Parkersburg.

W. J. RICHARDSON, formerly of Ann Arbor, Mich., recently resigned his position as manager of the Carlisle Electric Light and Power Company, of Carlisle, Ky., to become superintendent of the Radford Light & Power Company, of Radford, Va. Mr. Richardson is to assume his new duties at Radford March 8.

PARKER H. KEMBLE, of Toronto, Canada, widely known in the Canadian public-utility field, has become electrical commercial manager of the Union Gas & Electric Company, of Cincinnati, O., and will take up his new duties in the Queen City at once. Mr. Kemble succeeds J. D. Lyon with the Union Gas & Electric, Mr. Lyon having recently resigned.

W. C. DAVENPORT, formerly in the electrical contracting business in Augusta, Ga., has recently been appointed superintendent of Fire and Police Telegraph departments of that city. Since Mr. Davenport's appointment he has secured an extraordinary appropriation of $15,000 for maintenance, extensions and improvements of the two departments, which are being put into first-ciass condition.

LEO SCHULER, secretary of the Elektrotechnische Verein, Berlin, Germany, attended the midwinter convention of the American Institute of Electrical Engineers, in New York City, as a delegate from the Verband Deutscher Elektrotechniker. He visited the factory of the General Electric Company at Schenectady, and returned immediately to Europe, sailing from New York on March 6.

J. M. P. HANSEN, district plant chief of the Joliet, Illinois, branch of the Chicago Telephone Company, has been appointed to the position of toll-line inspector of the entire Chicago Telephone system, comprising five counties in the northern part of the state, including Chicago and Cook County. He began his new duties on March 1. Mr. Hansen has been in the service of the company for 22 years. He was connected with the Joliet office for 12 years, going there as wire chief of the local branch.

DATES AHEAD.

Boston Automobile Show, Mechanics Building, Boston, Mass., March 8-22.

Minnesota Electrical Association. Annual convention, St. Paul, Minn., March 11-13.

Electrical Committee, National Fire Protection Association. Annual meeting, New York, N. Y., March 26-27.

National Association of Electrical Inspectors. Annual meeting, New York, N. Y., March 26-27.

American Electrochemical Society, Spring meeting, Hotel Traymore, Atlantic City, N. J., April 3-5.

Mississippi Electric Association. Annual convention, Natchez, Miss., April 21-23.

Iowa Electrical Association. Annual convention, Waterloo, Ia., April 23-24.

Iowa Street and Interurban Railway Association. Annual convention, Waterloo, Iowa, April 23-25.

The Society for Electrical Development, Incorporated. Annual meeting, New York, N. Y., May 13.

National Fire Protection Association. Annual meeting, New York, N. Y., May 13-15.

Association of Railway Telegraph Superintendents. Annual meeting, St. Louis, Mo., May 20.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 21-24.

Electrical Supply Jobbers' Association. Spring meeting, Chicago, Ill., May 26-28.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29.

National Electric Light Association. Annual convention, Chicago, Ill., June 2-5.

Canadian Electrical Association. Annual convention, Port Arthur and Fort William, June 23-25.

National Electrical Contractors' Association. Annual meeting, Chattanooga, Tenn., July 16.

Michigan Section. National Electric Light Association. Annual convention, Ottawa Beach Hotel, Ottawa Beach, Mich., August 19-21.

American Institute of Electrical Engineers. Annual Pacific Coast convention, Vancouver, B. C., September 9-11.

With the Electrical Manufacturers

The Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, Pa., has published bulletin No. 217, which describes a new inclosed type of lamp and scale for use with galvanometers in light rooms. Two forms of the outfit are made, one for horizontal reading and one for vertical reading. A 10-volt straight-filament tungsten lamp is used.

Busch-Sulzer Bros. - Diesel Engine Company, St. Louis, Mo., has issued a new bulletin giving the result of an exhaustive test of a 225-horsepower Diesel oil engine, in which perspective and sectional views of the Diesel engine are shown. The method of conducting the test is described and the results are set forth both in tabular and graphic form.

Pettingell-Andrews Company, Boston, Mass., has made the February issue of its monthly organ, *Juice,* a special architects' number. It contains a number of articles calling attention to the company's excellent facilities, through its illuminating-engineering and fixture-designing departments, for turning out original fixtures particularly adapted to exacting requirements. A number of fine illustrations bear out this statement.

Page & Hill Company, the well known cedar-pole concern of Minneapolis, Minn., has moved into larger and more commodious quarters at Rooms 912-914 Plymouth Building, Minneapolis. The company has added to its office force C. L. Hamilton, a graduate of the University of Minnesota and of the Minnesota School of Forestry. Mr. Hamilton, who has specialized in wood preservation, will act as Mr. Hill's assistant.

Menominee Electric Manufacturing Company, Menominee, Mich., has issued its new general catalog covering over 180 pages. Included therein are descriptions and illustrations of telephone apparatus of all sorts, telegraph apparatus, electric bells, buzzers and annunciators, electrotherapeutic equipment, magnetos, spark coils, suction cleaners, etc. There is also given much valuable information, with circuit diagrams, relating to telephone construction.

E. Frenkel, 141 West Eighty-fourth Street, New York, N. Y., is about to open a selling branch of Ercole Marelli Company, Limited, of Milan, Italy, sometimes known as the Italian Westinghouse Company. This company manufactures all kinds of electric desk, bracket, ceiling, exhaust and centrifugal fans for direct and alternating current; also special types for railway cars and ships. Direct and alternating-current motors from fractional horsepowers up to 250 horsepower, dynamos, air-cooled transformers and centrifugal pumps are also included in its regular lines.

Simplex Wire & Cable Company, Boston, Mass., has prepared a very convenient wiring computer, which will be of particular interest to electrical engineers and wiremen. This computer is mounted on stiff, thick celluloid and is of convenient pocket size. It consists of a circular slide rule particularly adapted for rapid wiring calculations. By use of it much laborious figuring can be avoided. On the reverse side of the card are printed handy tables of wiring data and decimal equivalents of fractions of an inch. The company will be glad to send one of these wiring computers to anyone who addresses its main sales office, 201 Devonshire Street, Boston.

The Valentine-Clark Company, Minneapolis, Minn., has retained the services of J. Alex. Navarre, who will represent the company at Toledo, Ohio, as eastern sales agent, with offices in Room 1012, The Spitzer Building. Mr. Navarre is one of the best known cedar-pole salesmen in the central and eastern markets and his acquisition by the Valentine-Clark Company will be valuable not only to the company but to users of poles in Mr. Navarre's territory, as it will assure his former customers greatly increased facilities and prompt shipments. Mr. Navarre will have charge of all sales east of Chicago. The opening of the Toledo office in conjunction with the Chicago office, which is in charge of J. A. Kinney, places the Valentine-Clark Company in excellent position to take care of its customers in that locality.

Allgemeine Elektricitäts Gesellschaft, Berlin, Germany, has issued two publications devoted to some of the products of its cable works at Oberspree. One of these deals with insulating materials, among which quite a variety are manufactured by the company under the trade names Tenacit, Stabilit, Eisengummi, Vulkanasbest, Vulkanfiber. Several of these are materials which can be readily molded and a variety of objects made from these materials are shown in the publication. Another publication describes and illustrates flexible steel-armored cable for use in connecting to portable lamps and other electrical devices in which ordinary drop cord would be entirely unsuitable, due to liability of rough and severe handling. A number of typical views are given showing the use of this cable in shops, garages, etc.

Condit Electrical Manufacturing Company, Boston, Mass., has issued a number of new bulletins devoted to its circuit-breakers, oil switches, relays, etc. Bulletin No. 400 describes and illustrates carbon-break circuit-breakers of the type C and type K classes. These breakers are made in a variety of forms and for various purposes, among them being overload, underload, no-voltage, reverse-current and combination breakers. The construction of each of these forms, including the various methods of operating, is clearly set forth. Full data and dimension diagrams conclude this publication, which has 52 pages.—Bulletin No. 401 treats of type ID oil circuit-breakers, which are compact, totally inclosed breakers for alternating-current circuits up to 600 volts and 15 amperes, particularly for textile-mill motors. They have a simple automatic or non-automatic single-throw trip.—Bulletin No. 402 describes type LS oil circuit-breakers, which are made for circuits not exceeding 600 volts and 100 amperes. They are made for single or double throw, two, three or four poles, and for various mountings. Non-automatic or automatic trips with one or two coils are provided.—Bulletin No. 403 is devoted to type E oil circuit-breakers designed for circuits not exceeding 6,600 volts and 1,000 amperes. These breakers are for heavier service than the two preceding types and, like the LS switches, are made in a variety of forms.—Bulletin No. 404 takes up type DF oil circuit-breakers made for voltages up to 15,000 and currents to 1,000 amperes. They are intended for use in large substations and especially for feeders. The operation is either of the direct or remote mechanical type or electrical, a powerful electromagnet being employed in the latter case together with a control switch and pilot lamps. Time-limit or delayed-action relays are provided, if desired.—Bulletin No. 405 describes the main features of types F and FH oil circuit-breakers. These are intended for heavy duty in large central stations and are the largest Condit oil switches made. They are of compact and powerful design and the arc is broken under a very high head of oil. Their operation is either electromagnetic or pneumatic.—Bulletin No. 406 treats of series transformers for tripping circuit-breakers or for use with instruments. Their design produces a narrow transformer having a short primary winding, which makes them substantially explosion-proof.—Bulletin No. 407 briefly describes the principal types of direct-current and alternating-current relays made by the company especially for use in connection with circuit-breakers. Four kinds of action are provided, instantaneous, inverse delayed, definite delayed, inverse-definite delayed. The relays are made for either circuit-opening or circuit-closing.—Bulletin No. 408 dwells on type Y oil circuit-breakers designed for circuits not above 3,300 volts and 3,000 amperes. These breakers are particularly serviceable on heavy alternating-current distributing feeders where large currents and inductive loads necessitate special provision for powerful arc rupture. Copies of any of these bulletins may be had on writing to the company.

Record of Electrical Patents.

Issued by the United States Patent Office, February 25, 1913.

1,053,962. Machine for Winding Motors. A. Alexander, assignor to F. Bissell Co., Toledo. Includes a rotating winder and reciprocating carriage.

1,053,977. Electrogalvanic Generator. A. Dow, Wooster, O., assignor of one-half to C. C. Adams. A casing is specially arranged with connectors and terminals to contain a group of cells.

1,053,981. Locomotive D. T. Fisher, assignor to Jeffrey Manufacturing Co., Columbus, O. A short-base electric mine locomotive with a pair of large direct-connected driving wheels in the center and small guide wheels in front and back thereof.

1,053,997. Telephony. M. L. Johnson, assignor to Corwin Telephone Manufacturing Co., Chicago, Ill. Relates to the operator's listening switches and mechanism.

1,053,998. Telephone-Exchange System. M. L. Johnson, assignor to Corwin Telephone Manufacturing Co. Relates to the control of prepayment lines.

1,054,005. Decarbonization of Raw Metallic Filaments for Incandescent Electric Lamps. A. Lederer, assignor to Westinghouse Lamp Co. The filaments are heated in an exhausted vessel.

1,054,031. Electric Receptacle. N. D. Rand, assignor to Pass & Seymour, Solvay, N. Y. Includes a rectangular insulating base.

1,054,047. Field Magnet and Winding for Electrical Machines. C. H. Smoot, assignor to Rateau Turbine Co., Chicago, Ill. Provides additional shading coils on the tips of the commutating poles.

1,054,061. Trolley-Catcher. P. N. Van Epp, Port Clinton, O., assignor of one-third to L. E. Owen. A spring-controlled retriever mounted in a drum.

1,054,063. Carbon-Holder for Arc Lamps. M. C. Warren, Coffeyville, Kans. The carbons are held by wedge blocks in a recess.

1,054,068. Inclosed Fuse. H. R. Williams, assignor to Johns-Pratt Co., Hartford, Conn. The fuse element consists of a number of parallel strips of zinc among which are interwoven cross bands of insulating material.

1,054,081. Electric Wall Bracket. C. L. Bailey and L. E. Hale, Stockton, Cal. The horizontal stem of the bracket fits into a split clamping collar integral with a crow's foot and split base ring.

1,054,092. Trolley. A. Daszko and A. Bielech, Chicago, Ill. A trolley roller with two right and left-hand spirally grooved cones having a co-operating circular groove at the base ends.

1,054,098. Changeable Exhibitor. I. W. Edwards, Brooklyn, N. Y. Includes electric lamps and electric intermittent operation of a shutter.

1,054,110. Electric Switch. M. Guett, assignor to Hart & Hegeman Manufacturing Co., Hartford, Conn. Relates to detail of a snap switch.

1,054,111. Switch. M. Guett, assignor to Hart & Hegeman Manufacturing Co. Relates to further details of a snap switch.

1,054,115. Circuit-Breaker. F. Heath, San Diego, Cal. Mounted alongside a track rail.

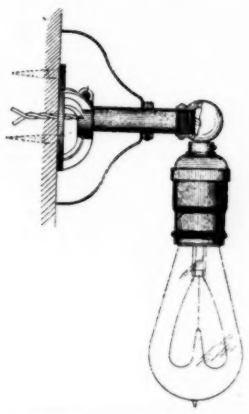
1,054,133. System of Electrical Distribution. D. B. Moist and C. W. Young, Harrisburg, Pa. Electrically operated switches for connecting feeders with different sections of trolley wire.

1,054,138. Means for Attaching Wires and Cables to Insulators. H. Parra, assignor to Société H. Parra et Cie., Toulouse, France. To an attachment collar fitting about the insulator are secured wire clasp and retaining loops.

1,054,140. Blue-Print Machine. C. F. Pease, assignor to C. F. Pease Co., Chicago, Ill. Includes arc lamps for printing a continuous web of paper.

1,054,144. System of Motor Control. J. H. Sandidge, Chicago, Ill., assignor of one-half to R. K. Winans. Control for a reversing series motor.

1,054,148. High-Voltage Strain-Insulator. L. Steinberger, Brooklyn, N. Y. Two separate stirrups are imbedded in an interlocking manner in a corrugated insulating cylinder with flaring end flanges.



1,054,081.—Wall Bracket.

1,054,162. Vehicle Lamp. J. E. Allen, assignor to Dearborn Hardware Manufacturing Co., Chicago, Ill. A parabolic-reflector headlight with electric lamp at the focus.

1,054,176. Telephony. E. R. Corwin, assignor to Corwin Telephone Manufacturing Co. Provides for party lines connected with an automatic exchange.

1,054,212. Contact for Screw-Plug Fuses. W. Klement, E. Kohrs and C. Leichtenschlag, assignors to Siemens-Schuckertwerke G. M. B. H., Berlin, Germany. Includes a flat contact face that engages conical laminae.

1,054,219. Electrical Circuit Controller. J. H. Lehman, New York, N. Y. A timer with eccentric rotating member.

1,054,227. Ground-Wire Connector. F. E. McKenna, Wauwatosa, Wis. Clamps a strap about the ground pipe and secures the ground wire thereto.

1,054,240. Timer and Switch Arrangement for Internal-Combustion Engines. J. M. Rhett, Beaufort, S. C. An automatic and a manual selective switch and a distributer.

1,054,243. Trolley-Pole. J. L. Rogers, Kansas City, Mo. Has a flexible helical-spring connection between the harp and pole.

1,054,257. Vapor Electric Apparatus. P. H. Thomas, assignor to Cooper Hewitt Electric Co., New York, N. Y. Two mercury-arc lamps arranged for series operation are each provided with a shunt and automatic cutout.

1,054,267. Railway-Signal Apparatus. D. Baker, Los Angeles, Cal. An electrically operated signal adjacent to a bridge.

1,054,275. Telephone-Switchboard. P. C. Burns, Chicago, Ill. Provides for a simple connection of the night-alarm circuit to all of the line units.

1,054,277. System for Protecting Trains. G. Carboni and C. Tironi, Florence, Italy. A block system with sectionalized conductors insulated from each other and from the track.

1,054,318. Electrically Heated Liquid Receptacle. E. Schwartz, assignor to Pelouze Manufacturing Co., Chicago, Ill. Relates to the attachment of the heating element to a chafing dish.

1,054,330. No-Voltage Circuit-Breaker for Alternating Current. C. C. Badeau, assignor to S. B. Condit, Jr., Boston, Mass. A oil circuit-breaker controlled by an electromagnet with large cast-iron core and armature.

1,054,336. Electric Writing Sign. H. D. Brown, Los Angeles, Cal., assignor of one-half to W. H. Clune. Is operated by a keyboard similar to that of a typewriter and includes selector, character and release switches, and relays for group and individual lamp circuits.

1,054,368. Electric and Automatic Control of Engines, Dynamos, and Batteries. L. Sunderland and G. C. Pillinger, London, Eng. A generating system with engine, generator and storage battery and automatic means for starting the engine when the battery load becomes excessive.

1,054,371. Electric Furnace. F. J. Tone, assignor to Carborundum Co., Niagara Falls, N. Y. A silicidizing furnace with a number of carbon resistance cores disposed for maximum radiation along their vertical surfaces.

1,054,372. Process of Silicidizing. F. J. Tone and T. B. Allen, assignors to Carborundum Co. Carbonaceous articles are changed to silicon carbide by being subjected to silicon vapors produced by an electric arc.

1,054,373. Method of Silicidizing Articles Containing Carbon. F. J. Tone, assignor to Carborundum Co. Uses the resistance furnace described in No. 1,054,371.

1,054,375. Means for Adjusting Tachometers for Temperature Compensation. C. H. Warner, assignor to Warner Instrument Co., Beloit, Wis. A thermostatic device for governing the field between a rotating magnet and a magnetic mass.

1,054,379. Electric-Bell Mechanism. G. B. Wurster, assignor to W. R. Ostrander & Co., New York, N. Y. Pivoted to the armature is a striker carrying a roller that engages the track plate.

1,054,380. Electric Furnace. T. B. Allen, assignor to Carborundum Co. A silicidizing furnace with resistors imbedded in the charge containing carbon and silicon.

1,054,383. Electric Trap. A. Bajluk and G. Borland, McKeesport, Pa. A

rat trap with an electrocuting platform.

1,054,419. Incandescent-Lamp Socket. B. H. Irish, assignor to Peru Electric Co., Peru, Ind. Has a spring disk bearing with pressure on the central contact of the lamp base.

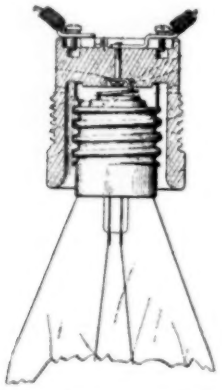
1,054,421. Railway Signal. E. Jennings, Windsor, Ontario, Can. Connected between the trolley and rails of an electric railway.

1,054,430. Passenger Car. W. Major, Chicago, Ill., assignor of one-half to A. Matzdorf. The steps can be swung up to form a platform, in either position being electrically locked.

1,054,435. Timing Device fo Photographic Printing Apparatus. D. McDonald, New York, N. Y. Includes electric lamps, a switch and dashpot.

1,054,455. Waterproof Incandescent-Electric Lamp Socket. E. L. Schneider, assignor to Crouse-Hinds Co., Syracuse, N. Y. Relates to details of a porcelain socket.

1,054,469. High-Voltage Strain-Insulator. L. Steinberger, New York, N. Y. A modification of No. 1,054,148,



1,054,419.—Lamp Socket.

in which elongated links with external eyes are used instead of stirrups.

1,054,494. Burglar Alarm. J. V. Bellamy, Vancouver, B. C. An open-circuit system with level gear, rack and pinion associated with the push-button.

1,054,497. Apparatus for the Electrolysis of Salt Solutions. J. Billiter, Vienna, Austria-Hungary. Special construction for the electrolyzing cell.

1,054,511. Indicator for Vehicles. J. L. Day, Memphis, Tenn. Electric lighting for an automobile-number casing.

1,054,520. Hair-Singer. E. H. Eldridge, Corpus Christi, Tex. Has an electric heating element near the open base of the casing.

1,054,559. Automatic Fuse Block and Relay Protector. T. B. Jones, Dome, Ariz. Has two parallel channels each containing plugs connected across in pairs by fuse wire; when a fuse blows its terminal plugs drop out and another fuse falls into place.

1,054,581. Telephonic Transmitter. W. J. Marchant, London, Eng. The mouthpiece is shaped like a parabaloid with the diaphragm in the focal plane.

1,054,582. Machine for Producing Printed Matter. E. M. v. Marchthal, assignor to Siemens & Halske A. G., Berlin, Germany. Includes an electrically controlled type wheel.

1,054,583. Apparatus for Closing an Electric Circuit at Predetermined Positions of a Collector. E. M. v. Marchthal, assignor to Siemens & Halske A. G. Includes a number of double-throw switches and a collector formed of slip rings divided into segments.

1,054,589. Device for the Production of Pure Air. H. Mestern, Berlin, Germany. Includes a high-tension ozonizer.

1,054,598. Photographic Recording Apparatus for Galvanometers, Oscillographs and the Like. E. Müllner, assignor to E. Huth, Berlin, Germany. A motor-driven sensitized tape receives the enlarged projected image.

1,054,601. Recording Device for Vehicles. S. T. Park and J. E. Phillips, assignors to Locomotive Recording Dynamometer Co., Chicago, Ill. An electric motor drives the record-sheet roll.

1,054,608. Device for Locking and Unlocking Window-Blinds and Doors. J. C. Peppers, New Orleans, La. Electromagnetically operated.

1,054,622. Apparatus for the Operation of Electrical Clocks by Electric Waves. F. Schneider, Fulda, Germany. Includes a coherer, a hammer, and decoherer.

1,054,624. Automatic Fire-Alarm. H. R. Shirley, Phoenix, B. C., Can. Includes contacts in a mercury tube.

1,054,628. Power Drive for Adding Machines. J. G. Vincent, assignor to Burroughs Adding Machine Co., Detroit, Mich. A motor drives the machine through an intervening clutch.

1,054,631. Machine for Making Temples for Spectacles. R. M. Weston, Southbridge, Mass. Has electrical control for part of the machine.

1,054,633 Sausage-Stuffer. M. Balcker, assignor to Blomfeldt & Rapp Co., Chicago, Ill. Includes an electrically operated air compressor that supplies the air to the meat-stuffing plunger.

1,054,646. Distance Gas-Lighting. S. Julian, London, Eng. Electric ignition.

1,054,647. Silica-Glass Electric Appliance. H. A. Kent and H. G. Lacell, assignors to Silica Syndicate, Ltd., London, Eng. A quartz tube with Molybdenum leading-in-wires.

1,054,652. Lamp Socket. S. Trood, New York, N. Y., assignor to Plug Connection Electric Co. Plug connection can be made through the open base of the socket.

1,054,653. Circuit-Controlling Apparatus. L. H. Thullen, assignor to Union Switch & Signal Co., Swissvale, Pa. The unequal expansion caused by subjecting two tension wires to currents of different frequency actuates a relay.

Reissues.

13,534. Electrical Distributing System. R. C. Leake, Auburn, N. Y. Original No. 853,888, dated May 14, 1907. An electric selective system controlled by impulses in the main line.

13,535. Protective Covering for Attachment Plugs. M. R. Rodrigues, New York, N. Y. Original No. 1,040,-762, dated Oct. 8, 1912. Has an intermediate tough body.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office that expired March 3, 1913.

555,487. Closed-Conduit Electric Railway. C. Anderson, Leeds, England.

555,491. District-Alarm System. M. E. Barret, Chicago, Ill.

555,503. Controlling Mechanism for Electric Motors. L. T. Gibbs, Milwaukee, Wis.

555,509. Electric Railway. R. M. Hunter, Philadelphia, Pa.

555,511. Method of Converting Potential Energy of Carbon into Electrical Energy. W. W. Jacques, Newton, Mass.

555,529. Motor-Hanger for Electrically Propelled Cars. E. Peckham, New York, N. Y.

555,544. Dynamo-Electric Machine and Electric Motor. G. A. Welles, Jr., New York, N. Y.

555,571. Trolley Pole and Connection. C. H. Finson, Pittsfield, Me.

555,585. Safety Appliance for Electric Brakes. W. B. Potter, Schenectady, N. Y.

555,589. Electric Meter. G. A. J. Telge, Oldenburg, Germany.

555,590. Monocyclic Generator. E. Thomson, Swampscott, Mass.

555,601. Electrical Railway-Signal. W. Fiedler, Charlottenburg, Germany.

555,621. Electric Arc Lamp. R. Schefbauer, Hoboken, N. J.

555,626. Facsimile Telegraphy. A. W. Storm, Ramsey, N. J.

555,628. Armature for Dynamos and Motors. G. A. Welles, Jr., New York, N. Y.

555,634. Trolley-Protector for Firemen. J. P. Barrett, Chicago, Ill.

555,645. Telephone-Call Register. H. Hempel, Berlin, Germany.

555,702. Electrical Measuring Instrument. A. H. Hoyt, Penacock, N. H.

555,706. Electric Arc Lamp. E. Lavens, New York, N. Y.

555,707. Signaling Circuit. J. J. O'Connell, Chicago, Ill.

1,054,469.—Strain Insulator.

555,725. Party-Telephone-Line Apparatus. A. S. Hibbard, Chicago, Ill.

555,783. Electric Propulsion System for Cars. G. H. Melotte, Marsh, Pa.

555,792. Method of and Apparatus for Magnetic Separation. J. P. Wetherill, South Bethlehem, Pa.

555,793. Separation of Franklinite Ore and Metallurgy Thereof. J. P. Wetherill.

555,794. Magnetic Separator. J. P. Weatherill.

555,800. Electric-Railway System. A. J. Beitzel, Boiling Springs, Pa.

555,832. Electric Coal-Cutter. I. E. Storey, Boulder, Colo.

555,841. Electric Arc Lamp. T. E. Adams, Cleveland, O.

555,846. Bond or Connector for Electric Railways or other Electric Conductors. A. Bournonville and J. J. Zimmerle, Philadelphia, Pa.

555,850. Core and Coil for Dynamo-Electric Machines. A. L. Cushman, Concord, N. H.

555,851, Armature for Induction Motors. A. L. Cushman.

555,862. Electric Railway Brake. J. C. Henry, Westfield, N. J.

555,891. Electric Arc Lamp. T. E. Adams, Cleveland, O.

555,895. Method of and Apparatus for Preparing or Treating Electrical Conductors. C. E. Carpenter, Bridgeport, Conn.

555,898. Armature for Induction Motors. A. L. Cushman, Concord, N. H.